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TREATISE

ON THE

MEDICINAL LEECH.

Fig 1.

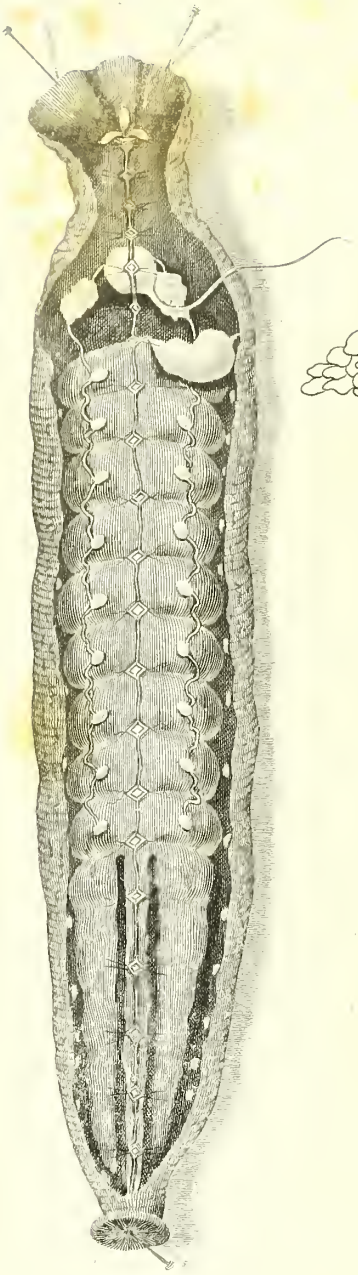
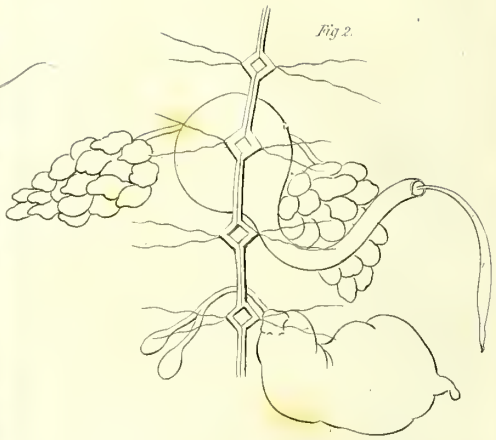


Fig 2.



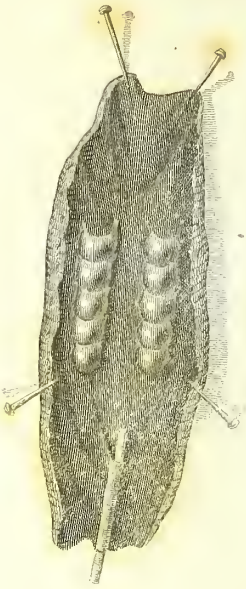


Fig 3.

P. Syme Delt

A

TREATISE

ON THE

MEDICINAL LEECH;

INCLUDING ITS

MEDICAL AND NATURAL HISTORY,

WITH A

DESCRIPTION OF ITS ANATOMICAL STRUCTURE;

ALSO, REMARKS UPON THE

DISEASES, PRESERVATION AND MANAGEMENT OF LEECHES.

BY

JAMES RAWLINS JOHNSON, M.D. F.L.S.
Member Extraordinary of the Royal Medical Society, Edinburgh.

ILLUSTRATED WITH TWO ENGRAVINGS.

Δεῖ μὴ δυσχεραίνειν παιδικῶς τὴν περὶ των ἀτιμωτέρων ζώων ἐπίσκεψιν: εν πᾶσι γαρ τοῖσ φυσικοῖς ἐνεστὶ τὶ θαυμαστὸν.

ARISTOTLE: B. i. c. 5.

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TO

THE RIGHT HONOURABLE

SIR JOSEPH BANKS, BART. K. B.

PRESIDENT OF THE ROYAL SOCIETY,

&c. &c.

THIS TREATISE

IS

WITH HIS PERMISSION

MOST RESPECTFULLY

INSCRIBED.

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Preface.

IN compliance with the established rules of the University of Edinburgh, every Medical Student taking his degree, is required to submit to the inspection of the Professors an Essay, either upon the subject of Medicine, or upon some branch connected with it; and should this essay meet with approval, it is then ordered, after the usual examinations, to be printed.

Dr. Monro, Professor of Anatomy and Surgery, &c. and then Dean of the Medical Faculty, to whom I presented my Thesis, was pleased to express his approbation of the manner in which I had executed it, and advised me to the present publication. This, I must confess, was my original intention; but I cannot forbear stating, that I publish this Treatise with the more confidence, as it comes forward under so respectable a sanction.

The Thesis alluded to (Disputatio Physica inauguralis quædam de Hirudine complectens, Ed. 1814) forms the outline of the present attempt.

Having acquired from my Father, in early life, a taste for Natural History, I have felt the greater interest since I took this subject in hand; but am constrained to observe, that an expression of regret was unwillingly drawn from me, on finding, notwithstanding the important services the Leech renders in Medicine, and its extensive employment among the Greek and Roman Physicians, that we should be still so ignorant of its Natural History. And such regret will, it is probable, long continue; for what is greatly to our disadvantage, all the operations of this useful animal are carried on beneath the waters, and thus evade our research; and the habits of the Leech, influenced as they must necessarily be in a state of confinement, will scarcely advance us a single step in obtaining any thing like satisfactory information.

I still however trust that I have brought forward all the evidence I could collect, either from the writings of naturalists, &c. or from enquiries made among those who were likely in any respect to forward my views. And here it would ill become me to omit naming Dr. T. W. Dyer, of Bristol, and Mr. Hebb, Surgeon, of Worcester; to whom I stand particularly indebted, no less for the handsome and ready manner in which my enquiries were replied to, than for the information thus acquired.

In the Section including the Medical History, the principal object I have had in view, is to shew that the Leech was frequently in use among the Ancients, and was thought highly efficacious in removing or at least lessening the influence of disease. And that this was not without a just foundation, may be fairly inferred from its being one of the few remedies possessed by the Ancients, which has continued down to the present day, with increased reputation.

The description of the Anatomical Structure of the Leech, I have given at some length, from the circumstance of its being so remarkably singular, and from having been enabled, by frequent dissection, to confirm or disprove the assertions of preceding writers. I may perhaps, by many, be considered to have enlarged unnecessarily; but I would rather on that account incur censure, than have failed to give every part of this interesting subject a full and deliberate discussion.

The observations offered in the last Section, regarding the Preservation of Leeches, will, I hope, be of service to those who keep them, and be the means of lessening the mortality, of which there are such frequent and loud complaints.

If in bringing forward this Treatise I have merited the commendation of the physiological enquirer, I shall consider myself amply rewarded, and be better contented to bear, in silence, the remarks of those who have the same aversion to the study of Natural History with my illustrious namesake; who, after the departure of a gentleman who had been amusing a friendly party by giving the Natural History of the Mouse, satirically exclaimed, "I wonder what he would have said, if he had seen a Lion!"

J. R. JOHNSON.

Bristol, Jan. 1816.

SECTION THE FIRST.

The Medical History of the Leech.

THE first introduction of the Leech into medical practice was doubtless suggested by its having been seen to pierce the skin of various animals, and gorge itself with their blood. The peasantry, it is probable, had long noticed this, and from observing no ill effects to follow their bite, might have been emboldened to make on themselves, as occasion required, trial of their efficacy.

The circumstance of the Leech being found to remove a certain quantity of blood from the circulating system *without producing any ill effect,* was the strongest recommendation in its favour; and the crude

notions then entertained, of diseases taking their origin from various humours generated in the system, must have contributed to its more immediate and extensive employment.

Agreeably to this idea, we feel little or no surprise that the Leech should be regarded by the Ancients as one of their first and most effectual remedies. Indeed Zacutus Lusitanus gives us this direct information, in the following passage. "Nam post celebrata præsidia universalia, ad Hirudinem, tanquam ad sacram anchoram, veteres necessitate quadam coacti, accedebant."

In the writings of Hippocrates, we find no notice of the Leech; and Cœlius Aurelianus quotes nothing concerning it, in the extracts he gives us from the writings of Diocles, Praxagoras, Herophilus, and other physicians, who lived between the times of Hippocrates and Themison.

Themison, who flourished in the first years of the Christian æra, and, as we learn

from Seneca, was the founder of a new sect in medicine, called the Methodic Sect, and greatly praised for the excellency of his writings by Democrates and Pliny, was the first who wrote on the utility of the Leech in medical practice. He was in the habit of applying a cupping-glass, after the Leech had quitted its hold, for the purpose of extracting a larger quantity of blood. What success attended him in this practice, he does not inform us. Celsus, however, remarks, that he was very skilful, and enjoyed a high reputation for the cure of various diseases; but in Juvenal we meet with the following Philippic.

"Quot ægros Themison autumno occiderit uno."
Satyra x. *v.* 221.

Antyllus, who flourished not long after Themison, had very frequent recourse to Leeches, when either the patient feared the lancet, or from an inequality or roughness of

the surface, he was prevented from using the cupping-instrument. They do not, he informs us, suck the blood from the internal parts, but only from those contiguous to the skin. When the hands or feet require their application, he directs these parts to be immersed in water in which Leeches are kept.

Menemachus, who also lived at an early period of the Christian æra, found in several diseases an excellent remedy in Leeches; but the number to be applied, he observes, must depend upon two circumstances—the size of the part and the nature of the affection.

Pliny, who flourished during the reigns of Tiberius, Vespasian, and Titus, by the last of whom he was greatly esteemed, and to whom he dedicated his diffuse and laborious work on Natural History, speaks of the great service Leeches are reported to produce in cases of Gout, and warmly recommends their application, in various diseases,

to the hæmorrhoidal veins. He also informs us, that the ashes of a burnt Leech, sprinkled over or formed into a kind of paste with vinegar, will remove hair from any part of the body to which it is applied. This practice is also noticed by Q. Serenus, in the following verses.

" Nec non quæ stagnis cessantibus hæsit Hirudo
Sumitur, et vivens samia torretur in olla;
Hæc acidis jungit permixta liquoribus artus,
Avulsamque vetat rursus percrescere Silvam."

Some little notice is said to be taken of Leeches, in a paper ascribed to Galen, " De Cucurbitulis, De Scarificatione, De Sanguisugis, &c." but this appears to have a slight foundation; as Galen was far from giving in to the opinions of the methodic sect, who were in the frequent habit of using them; of which sect Themison, as before remarked, was the founder, and Antyllus and Menemachus the zealous partisans.

Aretæus recommends the use of Leeches

in Angina accompanied with Dyspnœa, and advises their application to the hips in Satyriasis. The most learned of the ancient physicians, he informs us, preferred their use to the taking away blood by other means, from the idea of their being capable of removing any offensive humour from the body, however deeply it might be seated.

Oribasius, who flourished about the year 330, wrote on the advantage of extracting blood by Leeches. In a chapter devoted to Inflammations of the Eyes, he recommends their application to that side of the forehead corresponding to the part affected.

Ætius, who lived in 445, in his treatise "De atra Bile sive Melancholia," mentions his successful application of Leeches, in all cases in which the liver was affected.

Æginetus, who flourished in the early part of the seventh century, takes occasion, in pointing out the method of curing the pain of the head in Fevers, to mention

Leeches, and advises them to be applied, the head being previously shaved, to the occiput.

Actuarius, of whom it is recorded that he practised medicine with the greatest success at Constantinople, recommends their adoption in those instances where there is reason to suppose that corrupt and putrid blood has been collected. In cases where we dare not open a vein or apply the cupping-instrument, they have, he says, when opportunely applied, the happiest effect, and in various affections of the Head, constitute our best remedy.

Alexander Benedictus describes leech-bleeding as highly advantageous in cases of Vertigo, especially if the Leeches are applied behind the ears. Their application also to the gums will, he says, allay rheumatic pains of the Teeth.

Arnoldus recommends their speedy adoption where a wound has been inflicted by a

rabid animal, observing, that a due quantity of blood should be afterwards taken away by means of the cupping-glass.

Gariopontus speaks of their efficacy in Lethargy, when applied to the fore and back part of the head; and in Epilepsy, arising from melancholy, when applied to the region of the spleen.

Hieronymus Mercurialis, who was in such high esteem as a physician, that he was sent for to Rome, to attend Pius IV. was in the frequent habit of employing them, although he imagined they were not altogether capable of removing the whole of the evil of which the patient might complain; for the orifice, he remarks, made by the Leech, is so small, that none but the thinner portions of the blood can escape; the thicker part, from which he supposes the evil to arise, being still retained.

Horatius Augenius, in his treatise "De Sanguinis Missione," contemns bleeding

children by means of the lancet, and advises Leeches as a substitute.

Leonardus Botallus received, in the course of his practice, the greatest benefit from Leeches, when applied to the smaller members of the body, as the ears, nostrils, fingers, &c. An old Leech, he informs us, is of little or no use; and a Leech that has once bitten should be laid aside, as it is seldom found to go through its accustomed office again.

Mundella recommends the application of Leeches to an inflamed leg, and to the hæmorrhoidal vein, in all cases of continued Fever.

Petrus Salius, in his treatise on Fevers, speaks highly in their praise, observing that they effectually remove the humours at that time generated.

Zacutus Lusitanus asserts, that the Leech not only draws blood from the veins contiguous to the skin, but also from deeply

seated parts of the body; hence its utility in Fevers deriving their origin from a thickened state of the humours. To moderate violent pains of the temples, he disposes them in a circular manner, to the number of ten or twelve on each temple. He gives the case of a man with a painful affection of the hip, who was bled both in the ankle and in the arm, without experiencing the slightest relief; but on applying eight large Leeches over the part affected, the patient was free from his complaint within the space of a few hours. This author also relates a case of Phrenitis, arising from a retention of the menses; for the cure of which, as other remedies had failed, he ordered four Leeches to be fastened by a piece of thread, and then applied as closely as possible to the uterus. From the quantity of blood thus lost, the delirium was removed, and the woman in a few days recovered. Z. Lusitanus is so warm an

advocate for their employment, that he declares there is no disease but will become mild under this mode of treatment, and particularly should the Leeches be applied to the vessels of the anus. What inclines him to this opinion is, the close connexion which exists between the hæmorrhoidal veins and other parts of the body; hence all offending humours may be easily removed.

We might with but little trouble trace the medical history of the Leech down to the present time; but this I conceive unnecessary. Enough has been already said to prove, that its introduction into the school of medicine is of ancient date; and every day's experience serves to confirm the reputation it then so justly acquired.

Notwithstanding the Leech was thus highly valued, the Ancients were afraid of the ill consequences that might arise from

having swallowed one by accident; we therefore find in their writings a long list of remedies suited to each particular case.*

Oribasius recommends the person who has the misfortune to swallow a Leech, to drink plentifully of vinegar; but a better remedy

* These apprehensions were not, it will be seen, ill grounded. "When the French army entered upon the deserts which separate Egypt from Syria, the soldiers, pressed by thirst, threw themselves on their mouths and nose, and drank greedily of the muddy water they met with, and which, unknown to them, contained Leeches, having the form of a horse-hair, and being only a few lines in length. Many of them felt immediately stings or prickling pains in the posterior fauces, followed by frequent cough, glairy spots lightly tinged with blood, and a disposition to vomit, with a difficulty of swallowing, laborious respiration and sharp pains in the chest, loss of appetite and rest, attended with great uneasiness and agitation. On pressing down the tongue of the individual first attacked, a Leech was discovered, which was with difficulty removed by the forceps. Little or no hæmorrhage followed, and the patient recovered. Leeches that had attached themselves to the posterior fauces, were removed by the use of gargles composed of vinegar and salt-water. The Chief of Brigade, Lateur Mauberg, commander of the 22d Regiment of Chasseurs, swallowed two in the desarts of St. Makaire, a day's journey from the Pyramids; which so much weakened him, that his convalescence was long and difficult."—*Med. and Phys. Journal.*

than all, he says, is garlic; which, from its heating property, soon expels them.

Ætius informs us, we may readily know when a Leech has been swallowed, by the burning sensation which the patient experiences in his stomach and throat. If the pain is confined to the stomach,* he recommends a large draught of salt-water in which assafœtida has been dissolved, or the remedy

* Should the Leech reach the stomach, it probably would not long survive; for it appears from an experiment made by Dr. Stevens on an Hussar, whom he describes as gaining a miserable livelihood by swallowing stones for the amusement of the common people, and from which practice his stomach was so much distended that he could swallow several stones at a time, that the Leech is (contrary to what one would suppose) acted upon by the gastric fluid. The Doctor enclosed one of these animals alive, in a silver sphere perforated with small holes, and gave it to the Hussar to swallow; who voided it in about four and twenty hours; when nothing was found except a black viscid miasma, the remains of the digested Leech. This experiment, on a first view, it might be imagined, militates against the opinion of that ingenious physiologist, John Hunter; who states that the human stomach, on account of the vital principle it possesses, is never, during life, acted upon by the gastric fluid; nor is any other substance, he remarks, that is similarly endowed. In all likelihood, the vital principle of the

of which he speaks favourably, shoemaker's blacking (atramentum sutorium) dissolved in vinegar. If the pain be felt in the throat, the patient, he says, would do well to retain in his mouth two or three spoons-full of cold water; which often answers the purpose of luring the Leech from its retreat. Sternutatories should by no means be unemployed: the best are those composed of hellebore and elaterium.

Avicenna, who flourished in the year 980, of whose professional attainments the Arabian writers speak highly, advises the poor sufferer to take garlic and wormwood, mustard, and other acrid substances, and to refrain from speaking.

Leech was extinct before the gastric fluid began to exercise its effects; and I have the stronger reason for supposing this to have been the case, from the circumstance to which I shall soon advert, of one Leech *(H. Vulgaris) living* within the body of another *(H. Sanguisuga)*, nearly three days.

Leeches, according to the opinion of ancient writers, are unfit for medical purposes when they are of a very red or black colour. If these, they say, should be unfortunately applied, they immediately give rise to Fever, Diarrhœa, and Syncope, and sometimes even produce inveterate ulcers. To prevent these ill effects, they recommend their being chosen with small heads and of a brown or green colour. They should also have longitudinal lines on the back, and be taken from waters where there is an abundance of frogs.

Previously to their application, the Ancients recommend them to be thrown into water moderately warm, and afterwards placed on a piece of sponge, that by moving over it they might rid themselves of the viscid humour, virus, or oil, as they term it, attached to their surface. To induce them to fix on the skin the more readily, the part affected

was frequently punctured with a lancet; or when this was not consented to, blood or milk was applied to the skin, with the same intention. When the Leech was firmly applied and in the act of suction, advantage was now and then taken of snipping off the tail.* By this method, we are informed, one Leech will answer the purpose of several; for it still continues drawing the blood as before, which flows drop by drop from the wounded extremity.

To make the Leech disgorge the blood, the Ancients were in the practice of sprinkling over its surface the muriate of soda (common salt) and vinegar; and to restrain the bleeding, when profuse, they relied upon the application of bole armeniac, powdered aloes, and sometimes applied to the bleeding orifice a sponge dipped in liquid pitch.

* This was the case, I find, so early as the time of Pliny.

If a Leech at any time remained affixed longer than ordinary, it was a common practice to expose it to the fumes arising from burnt hair or wool; or in case this did not succeed, a horse-hair was inserted between its mouth and the part to which it was attached; the Ancients being unwilling to dislodge it by forcibly tearing it away, lest its teeth might be left in the wound, and thus prove fatal; which we are told by Pliny, happened to Messalinus, one of the patrician consuls.

Although many of the notions entertained by the Ancients relative to the Leech are highly erroneous, yet we must allow they justly appreciated its value in several distressing diseases. The Moderns, however, while they reject many of their crude and

undigested ideas, are equally aware of its importance; but acting upon more correct and scientific principles, obtain greater and more extensive advantage from its use.

SECTION THE SECOND.

The Natural History of the Leech.

IN regard to the genus *Hirudo*, much confusion at present prevails, solely attributable to the placing and retaining in that genus several animals in no respect corresponding to the generic character as given by Linnæus.

Dr. Shaw, after remarking that among the variety of the smaller animals there are many that have no place in the Systema Natura of Linnæus, proceeds to the description of what he has denominated a new English Leech, to which he assigns the name of *Hirudo viridis*, giving its specific character in these words: *H. viridis oblonga*,

extremitate acutiuscula. "It is found," he says, "in such waters as are more than commonly clear and cold, or at least such as do not very easily freeze during a common frost. It is about an eighth of an inch in length, bears a resemblance to the *H. complanata*, and is in colour of a deep grass-green, with a transparent edge or border. It has two eyes, of a deep black. Its motions are analogous to those of the *H. complanata*, *H. stagnalis*, and *H. octoculata*; but it possesses a greater degree of contractile power, since it often assumes a shape approaching to a circular outline. Its general motion is an uniform smooth progression, occasionally varied by a circular movement, as if turning slowly on an axis."*

A description of three new species of *Hirudo* has been also given by the Rev. William Kirby; the *Hirudo alba*, *Hirudo nigra*, and the *Hirudo crenata*.

* Linn. Trans. vol. i. p. 93.

Hirudo crenata. *H. subdepressa subovata striata, striis transversis annularibus, margine crenulato.*

" This species is of a greenish cast, sometimes inclining to ash-colour, with transverse annular striæ, from whence arise the crenatæ of its margin. Its upper surface is somewhat convex. Its interanea are very visible, owing to its vitreous transparency. It has two eyes only, which are very much approximated. Its motion is very similar to that of the larvæ of the *Geometræ*, and is performed by means of the adhesive property of the head and tail."*

The Hirudo alba (*H. depressa alba in teraneis fuscis ramosis margine crispante, extremitate acutiuscula*), and the Hirudo nigra (*H. depressa nigra linearis abdomine nigro*) described in the paper from which the above is copied, have now taken their place in the genus *Planaria*.

* Linn. Trans. vol. ii. p. 316.

The *H. crenata*, from Mr. Kirby's description, answers so closely to that of the *H. complanata*, that I should take them to be one and the same, had not this gentleman declared that the *H. crenata* possesses two eyes only; and we find in the *H. complanata* as many as six.* It is a singularity, however, worth notice, that the figure of the *H. crenata*, accompanying his description, should be delineated with six eyes, and moreover shew a retractile tongue, which he does not even so much as notice. From this circumstance I cannot but think the *H. complanata* has been figured by mistake for the *H. crenata*.

Mr. Kirby in conclusion remarks, "the *H. alba*, *H. nigra*, and also the *H. viridis* of Dr. Shaw, appear to me not rightly referred

* The *H. complanata*, compressed between two plates of glass, exhibits six eyes; but subjected to no such pressure, the eyes are so closely set, that they appear to coalesce, favouring an idea, upon a cursory survey, of this species having two eyes only.

to this genus (*Hirudo*), as they by no means agree with the Linnæan definition, Corpus oblongum *ore caudaque in orbiculum expandendis se promovens.* The motion of these three species is uniform and equable, nor do they possess that orbicular adhesive expansion of the head and tail which constitutes the essential distinction of the genus *Hirudo.* Qu. are they sufficiently distinct to constitute a new genus ?"

Dr. Shaw, in reply, observes, that " the *H. nigra* is probably the *Planaria fusca,* and the *H. alba* the *Planaria lactea* of Gmelin. The *H. viridis* comes so near to the *Planaria punctata, viridis,* and *Helluo,* that it may be doubted whether it be really distinct, or a variety."

These several species are now found in Turton's British Fauna, under the genus *Planaria;* but in the Encyclopedia Londinensis the *H. viridis,* notwithstanding the statement of Dr. Shaw, in which he admits

the impropriety of so naming it, is still retained in the genus *Hirudo.*

The *Hirudo complanata* and the *Hirudo stagnalis* are similarly situated. They have a character dissimilar to the Leech; 1st, in being furnished with a retractile tubular tongue; 2d, in having a flattened body; 3d, in attaching themselves, not by any expansion, but by an adhesive property of the head and tail. This dissimilarity, therefore, leads me to constitute a new genus, to which, from the prominent feature of the retractile tubular tongue,* I give the name from γλωσσα, a *tongue*, and σιφων, a *tube*, of

* In reference to this retractile tongue, but without considering it to be tubular, we find, in Müller, the following passage: "Articulum spiculi forma, quem clarissimus Bergmann *H. complanatam* ore exserere vidit, et cujus usum se ignorare fatetur, nunquam etiamsi per plures hebdomadas inquirerem, observavi, at *H. vulgarem* vidi organum tale ore protrudere et retrahere, quo viso, dictus articulus Bergmanni mihi in mentem venit, cum vero intra minuta pauca totum spiculum projecerit, mox patuit, esse *vermiculum* aquaticum, quem exsuctum evomerat. Ita autor facile in errorem induci potuerit." *Hist. Verm.* 1774. p. 49. This remark

GLOSSIPHONIA.

Character Generis.

Corpus subovatum depressum, caput acuminatum, lingua tubulata, os caudamque alterne affigendo progrediens.

G. Tuberculata,

olim

H. Complanata.*

Glossiphonia dilatata, supra cinerea, linea duplici tuberculata, subtus grisea, atomis nigris innumeris.

of Müller does not in the slightest degree invalidate the assertion of Bergmann. In observing the movements of the *H. complanata* and *H. stagnalis*, I have occasionally seen this tongue protruded, in which state it usually remained a few seconds, being thrown from side to side, in a waving direction, and then gradually withdrawn. It is thicker at its point than at its base, and may at any time be brought into view by gentle compression between two plates of glass. By means of this retractile tubular tongue, these animals are enabled to draw up, as through a siphon, the animalculæ in the water which constitute their food.

* This species, when touched, buries its head under its body, and rolls itself up, somewhat after the manner of an *Oniscus*.

Oculi sex—more delineato, ⁝⁝

Long. Lineæ octo.

In Rivulis.

Linnæus,	*Syst. Nat.* XII. 2, p. 1709, n. 6.
———	*Faun. Suec.* 2082. Hirudo depressa ovato-oblonga interaneis fuscis pinnatis pellucentibus.
Hill,	*Hist. Anim.* p. 16. Hirudo lateribus attenuatis.
Bergmann,	*Act. Stockh.* 1757, tab. vi. fig. 12, 14. Hirudo sexoculata.
Muller,	*Hist. Verm.* 2, n. 157, p. 47. Hirudo complanata.

G. Perata,*

olim

H. Stagnalis.

Glossiphonia gracilis, cinereo-viridis, punctis plurimis subnigris.

Oculi duo—more delineato, ..

* I have given this animal the specific name of *Perata*, from the circumstance of its having an abdominal pouch, to shelter its young. If this pouch should be common to any other species that may hereafter fall under this genus (not having seen such in the *G. Tuberculata)*, the name will of course be inappropriate, and must be changed.

Long. Lineæ octo.

In Rivulis.

LINNÆUS, *Syst. Nat.* XII. 2, p. 1079, n. 5.
———— *Faun. Suec.* 2081. Hirudo (stagnalis) depressa nigra, abdomine subcinereo.
MULLER, *Hist. Verm.* 2, n. 171, p. 41. Hirudo bioculata.
BERGMANN, *Act. Stockh.* 1757, n. 4, tab. 6, fig. 9—11. Hirudo bioculata.

This species has an abdominal pouch, in which the young, after their exclusion from the ova, are sheltered, and in which they remain (occasionally leaving it) for some weeks, adhering by their tails, and enjoying a free extent of motion with the rest of the body. The *G. Perata* is remarkable also in being enabled to move on the top of the water, its belly being uppermost, as freely as in any other position.

A Leech has been described, inhabiting the Thames, under the name of *Hirudo circulans*,* but it is clear that it cannot belong

* Sowerby's British Miscellany, tab. 76.

to that genus, when we read the description of it, which runs thus: *Oblong, pointed towards the head, convex above, flat beneath, dull red;* and equally clear, that if it be furnished with the retractile tubular tongue, regarding which I have little doubt, it will fall under the genus GLOSSIPHONIA. The body of this species is about an inch in length, convex, and obscurely striate on the upper side, flat, and paler beneath.

The *Hirudo crenata* of Mr. Kirby will be probably found to belong to the same genus.

This remark may equally apply to one or more, still retained in the genus *Hirudo*; but until the propriety of their removal be fully ascertained, it will be proper that we retain them in their original situation.

We shall now proceed to the consideration of this genus, distributed into two divisions; the first including those Leeches found in

rivers or in stagnant waters; the second, those found in the sea.

HIRUDO.

Character Generis.

Corpus oblongum subrotundum, anterius et posterius truncatum, muticum, cartilagineum, os caudamque dilatando progrediens.

Hirudines in Rivis, Stagnis, Paludibusque habitantes.

H. Medicinalis.

Hirudo depressa nigricans, supra lineis flavis sex, intermediis nigro arcuatis, subtus cinerea nigro maculata.

Oculi decem,* more delineato,

* No Leech has been hitherto described with more than eight eyes. In the *H. medicinalis* and *H. sanguisuga,* no notice has been before taken of an organ of vision.

Long. Pollices tres.

In Stagnis—Paludibus.

Caput—quiescens subrotundum, progrediens acuminatum.

Os—quoad figuram mutabile, rimam triangularem plerumque exhibens.

Cauda—circularis, complanata, fibris carnosis e puncto centrali divaricatis.

Linnæus,	*Syst. Nat.* XII. 2, p. 1079, n. 2.
———	*Faun Suec.* 2079.
Hill,	*Hist. Anim.* p. 16. Hirudo nigrescens flavo variegata.
Gesner,	*Pisc.* 425. tab. 425. Hirudo major et varia.
Muller,	*Hist. Vermium*, 2. n. 167, p. 37.
Barbut,	*Genera Vermium*, p. 19, tab. 2, fig. 5.
Weser,	*Amœnitates Academicæ*, tom. vii. p. 42.
Bergmann,	*Act. Stockh.* 1757, p. 308, n. 4, tab. 6, fig. 1, 2.
Gisler,	Ibid. 1758, p. 95.
Saloman,	Ibid. 1760, p. 35.
Shaw,	*Naturalist's Miscellany*, tab. 218.
Pennant,	*British Zoology*, vol. iv. p. 36.

H. Sanguisuga.

Hirudo elongata fusco-viridis, subtus cinereo virens, maculis nigris.

Oculi decem.

Long. Pollices tres.

In Stagnis—Locisque palustribus.

Linnæus,	*Syst. Nat.* XII. 2, p. 1070, n. 3.
———	*Faun. Suec.* 2078.
Weser,	*Amœnitates Academicæ*, tom. vii. p. 44. Hirudo depressa fusca; margine laterali flavo.
Hill,	*Hist. Anim.* p. 16. Hirudo nigra abdomine plumbeo.
Raius,	*Ins.* 3. Hirudo maxime vulgaris.
Muller,	*Hist. Verm.* 2, n. 168, p. 38.
Bergmann,	*Act. Stockh.* 1757, n. 4, tab. 6, fig. 3, 4.
Gisler,	Ibid. 1758, p. 95—2.
Barbut,	*Genera Vermium*, p. 20, tab. 2, fig. 6.
Shaw,	*Naturalist's Miscellany*, tab. 218.
Petiver,	*Gazoph. Naturæ et Artis*, tab. 130, fig. 7.

H. Troctina.*

Hirudo elongata fusca, supra annulis aureis

* I am not aware of this species having been hitherto described. I have denominated it *Hirudo Troctina*, from its resemblance, in regard to the coloured rings or spots, to the Trout, and also from its being known and sold in the shops under the name of the Trout-Leech. Owing to the great scarcity of the medicinal or striped Leech, it has been latterly employed in medicine.

maculas atras cingentibus, margine sub-flavo laterali, subtus flavo-viridis punctis atris.

Oculi decem.

Long. Pollices tres.

In Rivis—Piscibus crebro adhærens.

H. Nigra.*

Hirudo elongata, per totum corpus, nigerrima.

Oculi decem.†

Long. Pollex.

* This is here described as a new species: how far I am correct in this particular remains to be ascertained. The whole of the body is of a deep jet-black; which, on being held up to the light, exhibits several transparent bladder-like bodies, ranged along the sides. This species I preserved upwards of eight months. It is the only one of the kind I have ever seen, and was found in a rivulet near Bristol. It had all the external character of the Leech, but in its habits presented an essential difference. It was remarkable for its inactivity, was commonly coiled up, and seldom took to the water.

† The eyes of the *H. nigra, H. troctina,* and *H. sanguisuga,* present the same figure as those of the *H. medicinalis,* in p. 29.

In Rivulis.

H. Vulgaris.*

Hirudo elongata flavo-fusca, supra lineis nigris transversis, subtus immaculata.

Oculi, more delineato, octo.

Long. Poll. $1\frac{1}{2}$.

In Rivulis.

Linnæus, *Syst. Nat.* XII. 2, p. 1079, n. 4.
——— *Faun. Suec.* 2080. Hirudo (octoculata) depressa fusca, punctis octo nigris supra os.
Bergmann, *Act. Stockh.* 1756, p. 199—1757, tab. 6, fig. 5, 8.
Muller, *Hist. Verm.* 2, n. 170, p. 40.

H. Tessulata.

Hirudo dilatata cinerea, margine tessulato, supra maculis albis vel aurantiis, subtus grisea, maculis duabus albis.

Oculi octo.

* Having kept, during the last summer, several of this species, I noticed this circumstance,—that they deposit their ova at two periods of the year, the months of July and October.

Long. Poll. $1\frac{1}{2}$.

In Rivis—rara.

Muller, *Hist. Verm.* 2, n. 173, p. 45.

H. Lineata.

Hirudo elongata grisea, dorso lineis quatuor longitudinalibus nigris.

Oculi sex.

Long. Poll. $1\frac{1}{2}$.

In Paludosis—rara.

Muller, *Hist. Verm.* n. 169, p. 39.

H. Heteroclyta.

Hirudo dilatata, pellucida, flava, punctis atris striata, margine integro.

Oculi quatuor.*

* The *H. Heteroclyta* is sometimes seen with six eyes; and what is remarkable, Müller once observed one of this species, with four eyes, bring forth young, "quatuor et sex oculis gaudentes." *Hist. Ver m.* 1774, p. 50.

Long. Lineæ octo.

In Rivulis.

Linnæus,	*Syst. Nat.* XII. p. 1080, n. 7.
Muller,	*Hist. Verm.* n. 176, p. 49. Hirudo hyalina.
Trembley,	*Hist. Polyp.* tab. 7, fig. 7.
Ledermuller,	*Microscop.* p. 165, tab. 84, fig. *k*, *q*.

H. Geometra.

Hirudo elongata, flavo-viridis, maculis albis.

Oculi quatuor.

Long. Lineæ octo.

In Rivis—Piscibus creberrime adhærens.

Linnæus,	*Syst. Nat.* XII. 2, 1080, n. 8.
———	*Faun. Suec.* 2083. Hirudo teres extremitatibus dilatatis.
Hill,	*Hist. Anim.* p. 17. Hirudo dorso elevato, cauda latiore.
Frisch.	*Ins.* 6, p. 25, tab. 11. Hirudo ore caudaque ampla.
Raes.	*Ins.* p. 399, tab. 32. Hirudo piscium.
Muller,	*Hist. Verm.* 2, n. 172, p. 43. Hirudo piscium.
Bergmann,	*Act. Stockh.* 1757, p. 310, n. 3.
Ræsel.	*App.* tab. 32, fig. 1, 4.

Ledermuller, *Microscop.* tab. 84, fig. *a. i.*
Barbut, *Genera Vermium,* p. 20, tab. 2, fig. 7.
Pennant, *British Zoology,* vol. iv. p. 38, tab. 20, fig. 13.

H. Marginata.

Hirudo dilatata, fusca, margine tessulato, subtus subtilissime striata.*

Oculi quatuor.

Long. Pollex.

In Rivis—rara.

Muller, *Hist Verm.* 2. n. 174, p. 46.

Hirudines in Oceano habitantes.

H. Indica.

Hirudo depressa, fusca, striis muricatis transversis.

In maritimis. India.

* All the Leeches hitherto described, with the exception of *H. lineata, H. tessulata,* and *H. marginata,* are to be met with in this island.

H. Grossa.

Hirudo dilatata, subflava, striis albis pulcherrimis.

In Oceano.

Muller, *Zool. Dan.* 1. p. 69, n. 27, tab. 21, fig. 1, 5, prodr. p. 2668, rar. 1, p. 43.

H. Hippoglossi.*

Hirudo dilatata subalbida, supra versus caput maculis cinereis duabus, subtus versus caudam linea tuberculata.

In Oceano—cuti *Pleuronectis Hippoglossi* adhærens.

Muller, *Zool. Dan.* 2, tab. 54, fig. 1, 4, prodr. p. 2669, rar. 2, p. 41.
O. Fabr. *Faun. Grænl.* p. 302, tab. 1, fig. 8.
Baster, *Opusc. Subsec.* 2, p. 138, tab. 8, fig. 11.

* It appears from a passage in Müller, that this species will occasionally move in the water after the same manner as the *G. Perata.* "Præter hunc incessum *(more geometrarum)* alium in hac specie observavi inversum nempe, dum corpore supino summum aquæ ore et cauda alternatim prehendit." *Hist. Verm.* 2, p. 51.

H. Branchiata.

Hirudo depressa attenuata alba, setis lateralibus ramosis utrinque septem, interaneis fuscis bifidis perlucentibus.

In Oceano Pacifico—*Testudini* adhærens.

Trans. Linn. Soc. vol. i. p. 188, tab. 17, fig. 3.

H. Muricata.

Hirudo elongata tuberculata, versus caudam maxime dilatatam attenuata, caput bicorne.

In Oceano septentrionali—Piscibus creberrime adhærens.

Linnæus, *Faun. Suec.* 2084.
Rondeletius, *Aquat.* 2, p. 111. Hirudo marina.
Baster, *Opusc. Subsec.* 1, p. 82, tab. 10, fig. 2. Hirudo piscium.
Barbut. *Genera Vermium*, p. 20, tab. 2, fig. 8
Mus. Adolph. Fred. 1, p. 93, tab. 8, fig. 3.
Pennant, *British Zoology*, 4, p. 38, tab. 20, fig. 14.

H. Verrucosa.*

Hirudo elongata rotunda, annulis plurimis verrucosis.

In Oceano *Raiæ clavatæ* adhærens.

Encyclopedie 7^e^. liv. des *Pl. d' Hist. Nat.* *Helminthologie,* pl. 52. fig. 5.
Mem. Wernerian Nat. Hist. Soc. 2, p. 245.

Having thus brought into view the whole of the genus *Hirudo,* we shall now pass on to the Natural History, more particularly as it relates to that species employed in Medicine.

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* We are indebted for a full description of this species, which bears a close resemblance, with the exception of its having no horns on the head, to the *H. Muricata,* to the Rev. John Fleming, who introduced it to the notice of the Wernerian Natural History Society, in a paper since published in their Memoirs.

The Leech has received from almost all nations, an appellation corresponding to its well-known property of attaching itself to the skin, and thence drawing the blood. By the Greeks it was named βδελλα (by Nicander, φιλαιματ☞, and by Theocritus, from its inhabiting marshy situations, λιμνητις); by the ancient Romans, *Hirudo,* or, without the aspirate, *Irudo;* and by the modern Romans, *Sanguisuga.** By some Italians it is called *Sanguisuca;* by others, *Sanguettole;* by the French, *Sansue, Sangsue* or *Suce-sang;* by the Germans, *Ægle,* or *Egle,* or *Blüt-egle;* by the Germans of the Low Countries, *Lake,* or *Lycke-*

* Pliny, in describing the natural history of the Elephant, makes this remark. "Cruciatum in potu maximum sentiunt, hausta Hirudine, quam Sanguisugam vulgo cœpisse appellari adverto."—*Nat. Hist.* tom. i. p. 440. To this passage we find subjoined the following note: "Itaque Plinii ævo sanguisuga a suctu sanguinis cœpta est appellari. Qui certe Scriptores antea vixerunt, Hirudinem constanter vocant." The Leech was thus called *Hirudo,* from *haurio,* expressive of its well-known peculiar action.

lake; by the Danes, *Dokter-iglen,* or *Blod-igle,* and by the Poles, *Pijavvka.* In India, it receives the appellation, in the Hindustani language, of *Jonc;* in the Sanscrit language, of *Jelauca.*

The Medicinal Leech is common throughout the whole of Europe, but more so in the southern than in the northern parts. It is about three inches in length; but in the southern parts of America and India it is often found to be six or seven inches. Formerly this species was very abundant in our island; but from their present scarcity, owing to their being more in request among medical men, and to the rapid improvements which have of late years taken place in agriculture, particularly in the draining and cultivation of waste-lands, we are obliged to receive a supply from the Continent, chiefly from Bourdeaux and Lisbon.* These Leeches

* On a moderate calculation, we employ at least one hundred Foreign Leeches for every British Leech. I give this

differ from the Medicinal Leech of this country, in being larger, and having the belly of one uniform colour.

Leeches are observed to take their predominant or ground-colour, from the colour of the soil in which they are found. Mr. Baker, a man of some intelligence, residing in Glastonbury, and who for the last twenty years has been in the habit of collecting large quantities of Leeches for sale, informs me that at the *Back River*, near Glastonbury, they are black, from the peat being of that colour; at *Cook's Corner*, they are of a reddish cast, from the red peat; and at *Auler Moor*, where from a deficiency of peat they penetrate the clay, they are yellow. This assertion receives some support from its being remarked of the toad, that if it be much exposed to the light, its colour changes to that

as the opinion of a person who has for many years been a Leech-Dealer, and whose occupation enables him to give this statement on very satisfactory evidence.

of a pale green; but when it remains in the earth, and is not under its influence, it generally acquires the colour of the substance which surrounds it.* The *H. tessulata* is said to vary so much, in respect to colour, that unless it were continually observed, it would be taken for a different species.

Notwithstanding Leeches are thus subject to this change, they still offer spots or lines which are considered permanent, and upon which we may safely rest in giving their specific character.

The motion of Leeches in water resembles that of the Eel. They swim in a serpentine direction, and at times with considerable velocity. Besides this, they have a creeping motion, and are capable of moving the anterior extremity of their body, either forward or backward. When the Leech wishes to change its place, the circular muscles with

* Fyfe's Comparative Anatomy, p. 232.

which it is furnished are called into action: the diameter of the body being in this way lessened, the extension of the head is effected. Its attachment is then made secure by the sucker terminating that extremity. One point of attachment thus gained, the longitudinal muscles act in their turn, and draw the tail towards the head. The tail is then fixed by means of a similar sucker, and the head, by the re-action of the circular muscles, is again thrown forward. By these alternate movements, the Leech is enabled to move on a solid surface with great facility. When the Leech quits the bottom of pools, to reach the surface of the water, the body is projected at full length in an oblique position, and is then moved in a waving direction, upward and downward. By this action briskly repeated, the Leech is thrown forward, and soon accomplishes its purpose.

In winter, Leeches resort to deep water; but in summer they delight in the shallows, where they are more exposed to the influence of the Sun. When the weather is very severe in winter, or so dry in summer as to endanger the total drying up of the pools they inhabit, they retire to a considerable depth in the ground, leaving a small aperture to their subterranean habitation. They begin to make their appearance in the water about the latter end of March or the beginning of April. During a bright sunshine they may be seen very actively swimming from place to place; but should the weather prove cold or cloudy, they confine themselves to the mud. In rainy or windy weather, when the water is agitated, they retire from sight. Just before a thunderstorm, they commonly come up to the surface; and this the Leech-Gatherers find a good time for collecting them.

Leeches are said to predict changes in the weather, with so much accuracy as to serve for Barometers.

A Clergyman residing in France found that a Leech, enclosed in a glass vessel half filled with water, and kept in a window of his chamber, answered every purpose of a Barometer. Each morning, he informs us, the Leech had shifted its position, in strict unison with the varying state of the atmosphere. From attentive examination, he was enabled to acertain,—first, that when the weather was about to be serene and pleasant, the Leech remained at the bottom of the vessel without the least movement; secondly, that if it was about to rain, in either the fore or after noon, it mounted to the surface of the water, and there remained until the return of fine weather; thirdly, that on the approach of boisterous weather, it moved in the water with uncommon swiftness, and never ceased from this motion until the wind began to

blow; fourthly, that on the approach of weather attended with thunder and rain, it remained out of the water for several days, appearing agitated and restless; fifthly, that it rested constantly at the bottom of the vessel when a frost was about to commence; and sixthly, that during the time of snow or rain, it fixed itself at the neck of the vessel, remaining at perfect rest.* Cowper, the celebrated author of The Task, has asserted that Leeches, "in point of the earliest intelligence, are worth all the barometers in the world." Although I cannot agree with our poet, I will not say that Leeches are unaffected by the weather, since this is sufficiently proved by their restlessness on its various changes; being affected in like manner with those animals of which the Mantuan bard, in speaking of an approaching shower, gives so natural a description.

* Vide Supplement to the *Encyclopedie ou Dictionnaire Raisonne des Sciences;* article '*Sangsue,*' tom. 4, p. 733.

Aut illum surgentem vallibus imis
Aëriæ fugere grues:—aut buccula cœlum
Suspiciens, patulis captavit naribus auras:
Aut arguta lacus circumvolitavit hirundo:
Et veterem in limo ranæ cecinere querelam.
Georg. lib i. v. 374.

How far the remarks of either the French Clergyman or the Poet are worthy of notice, will appear by observing vessels in which Leeches are contained. Some Leeches will be seen in a state of rest, others in motion; some at the bottom of the water, others at the surface. I would therefore ask how it is possible they can furnish any thing like accurate indications of the state of the atmosphere?

The food of the Medicinal Leech is stated to consist of the larvæ of aquatic insects, worms, &c. These, it is true, constitute the food of the Horse-Leech (*H. sanguisuga*), but not that of the Leeches in medical use (*H. medicinalis* and *H. troctina*), which

subsist by feeding on the fluids of fish,* frogs, &c. A few memoranda on this subject may not prove uninteresting.

Having procured a Frog, I placed it in a vessel containing half a dozen Leeches (*H. medicinalis* and *H. troctina*), in which floated a piece of deal. The poor animal, finding itself surrounded, made every effort, but ineffectually, to reach the upper part of the float; while its enemies pursued it with more than common activity. At length one of the Leeches settled on the back, and the others affixed themselves to the legs. On the following morning the Frog was found dead, presenting, on different parts of its body, no less than eighteen wounds, all bearing the usual triangular appearance.

Being in possession of a common Water-Lizard (*Lacerta palustris*), I placed it in

* Leeches are frequently found affixed to that species of salmon, called the Shewen—*S. Eriox.*

a vessel with four Medicinal Leeches. The Leeches swam about, unconcerned, and the Lizard was removed in the course of a few hours, untouched. This indifference on the part of the Leeches, I attributed to their late feast upon the Frog. Four days afterward I replaced the Lizard, which had then lost somewhat of its activity, in its former situation, and had scarcely time to cover the vessel, before two of the Leeches began the attack by wreathing themselves around their prey, for the purpose of securing a firm hold. In a few minutes a wound was inflicted. The Lizard, hitherto motionless, now struggled violently to release itself. This struggle was continued at intervals, but without effect, for about half an hour; when the Lizard yielded to its fate.

I have frequently placed the common Earth-Worm (*Lumbricus terrestris*) in vessels with Medicinal Leeches, but never found it to receive the slightest injury; which is the

more singular, as the Earth-Worm contains red blood, a fluid for which the Leech shews great partiality. I have also presented to them different kinds of aquatic larvæ, but never observed the least disposition on their part to injure them. So far otherwise, that I have often witnessed the larvæ of the larger Water-Beetle *(Dytiscus marginalis)* in the act of seizing the Leeches by means of their mandibles. Hence it is sufficiently manifest, that neither the Earth-Worm nor the larvæ of aquatic insects constitute their food.

It may not be here out of place to mention a few similar experiments relative to the Horse-Leech; which differs from the Medicinal Leech, in possessing a voracious appetite, and in swallowing solid food.

In an early period of my investigation, I accidentally broke a phial in which was a Medicinal Leech. This I placed, unconscious of the consequence, in a glass vessel contain-

ing about forty Horse-Leeches. In a short time, I observed the Leeches to be clustered together, and the Medicinal Leech making great efforts to recover its liberty. On separating them, I found the latter to have received three wounds, of which it soon recovered when replaced with its own species. This led me to the following experiments.

I procured a large-sized Medicinal Leech, gorged with blood, and presented it to about thirty Horse-Leeches. As soon as the Medicinal Leech saw the others in motion, it endeavoured to avoid them by swimming to the surface. It was however in a little time seized upon and dragged to the bottom of the vessel. In a few minutes the water had assumed a bloody tinge, and the Leech was quickly deprived of life. To ascertain whether the Medicinal Leech was destroyed merely from the natural ferocity of its enemy, or to serve as food, I repeated the experiment, taking care previously to feed the Horse-

Leeches with Earth-Worms. This done, I presented to them two Medicinal Leeches, which immediately swam to the surface, and attached themselves to the upper part of the vessel, in order to avoid their enemies. This effort, however, might have been spared, for the *H. sanguisugæ* did not make the slightest attempt to molest or in any way injure them; it is therefore evident that they are destroyed solely for food.

I counted, in a glass vessel in which they were contained, sixty-five Horse-Leeches. Five days afterward, I found the number reduced to fifty-two. No less, therefore, than thirteen, had in the short space of five days been destroyed; not even a vestige was left to denote their former existence.

Two of the common Rivulet-Leeches *(H. vulgaris)* were presented to a Horse-Leech. In a short time, I observed the head of one of the former in the mouth of the latter, who, by the force of suction alone, drew the whole

animal into its stomach. This operation took up a quarter of an hour. Its gluttony, however, was not satiated, until it had swallowed the other. Three days afterward, one of these Leeches was thrown up *in a living state*, appearing to have suffered but little injury from its confinement, and was, after the lapse of a few hours, again swallowed.

It seems almost incredible that one Leech should remain within the stomach of another nearly three days, and yet be rejected alive. My friend Dr. M'Dougall was upon a visit to me at this time, and with another gentleman, had an opportunity of witnessing this singular occurrence.

Having observed a Horse-Leech to seize and swallow one of the small Leeches (*H. vulgaris*), I placed it aside, and in two hours opened the body. The *H. vulgaris* appeared, on a first view, nearly destitute of life; in the course of an hour it began to

move, and by the day following had regained its former activity. It was kept in a vessel by itself. On the fifteenth of July, twelve days from its liberation, it produced an ovum, and one also on each of the following days, viz. the 16th, 17th, 22d, 24th, 27th, 29th, 31st, and August 4th, 9th, and 16th. On the 22d it died. I have compared these ova with the ova of the same species met with in rivulets, and find an exact resemblance.*

Desirous to ascertain how many of the smaller Leeches would be swallowed in a given time, I kept two Horse-Leeches in

* I frequently, during the month of July, procured the ova of the *H. vulgaris*, from the rivulets in which these Leeches are found, and had the satisfaction to find them productive. These ova are, when first produced, of a bright amber-colour, gradually deepening to a dull brown. They are usually of an oval form, convex above and flattened beneath; but they take this figure only when agglutinated to any surrounding object; being, when deposited in an unattached state, mostly globular. On opening these ova, or, more correctly speaking, capsules, I have several times taken from each, from six to eight young, in colour of a grey-white, and of the size of the finest sewing-thread.

separate vessels for a month, supplying them constantly with the *H. vulgaris*, both in its dead and living state.

During the whole of this period I must observe the water was turbid, notwithstanding its occasional renewal, from the vast disengagement of fœcal matter which floated about, having a thread-like appearance.

Swallowed by No. 1.		*Swallowed by No.* 2.	
June 10,	two, dead 2	June 10,	one living and one dead....2
12,	two, living....2	11,	one, dead 1
15,	one, living....1	12,	one, living....1
20,	two, dead 2	16,	one, living....1
21,	one, dead 1	17,	three dead and one living....4
23,	one, living....1	19,	three, living ...3
25,	two, living....2	20,	three, living ...3
29,	two, living....2	July 2,	two, dead 2
July 3,	one, living....1	8,	two, living....2
9,	one, living....1	9,	one, living....1
	Total, 15		Total, 20

On the fifteenth of June, three *H. sanguisugæ* swallowed three *H. vulgares*. On the 20th, I opened the three, and could not, in

two, trace the least vestige of a Leech. In the third, I found a Leech about half digested, surrounded by a fluid in colour of a deep brown. The intestine in the others was filled with a similar fluid, but much thicker in point of consistence.

This experiment, with the preceding table, cannot but convince us of the activity of the digestive powers in the *H. sanguisuga.* This indeed may be also determined by a reference to its anatomical structure. In the *H. sanguisuga,* the intestine is more than double the width of that of the *H. medicinalis* and *H. troctina;* and the stomach is not so thickly set with membranous folds or partitions. A difference therefore in regard to food necessarily arises, from this difference of structure.

To the general law in cold-blooded animals, that digestion proceeds with great

slowness,* the experiment just mentioned offers a marked exception.

The digestive powers of the *H. sanguisuga* are probably more active during the summer than during the spring months. Trembley, the author of an interesting memoir on *Polypes*, has observed, that the influence of the weather greatly affects the digestive powers of those animals (Polypes); for when the weather is sultry, the same quantity of food is completely digested in twelve hours, as in a moderate temperature requires two or three days.

To several Horse-Leeches I presented some Elvers, in a dead state, and about three inches in length. As soon as I perceived a Leech in the act of swallowing one of them, I removed it from the rest, with the

* We learn from that indefatigable experimentalist, Spallanzani, that a Lizard, after remaining sixteen days in the stomach of a Viper, was found to have lost nothing of its original form—a remarkable instance of the extreme slowness of the digestive powers in cold-blooded animals.

view of observing it more closely. Apparently with the greatest ease, it received into its stomach the major part of the Elver, about two inches, but was unable, with all its efforts, to take in more. Finding it could not accomplish its purpose in swallowing the whole, and sensible of its motions being embarassed by what it retained, it fixed its tail closely to the side of the glass, and drew backward its head, and in this manner gradually shortening itself, was enabled to reject the recently swallowed food.

From this experiment we see that the *H. sanguisuga* enjoys the privilege of voiding by the mouth any thing it may be unpleasant to retain—a circumstance often observed in respect to Birds of Prey, who have the power of throwing up the feathers and hair of the animals they devour.

Fothergill relates the circumstance of a Tench *(Cyprinus tinca)* which was taken in the river Ouse, and put into a stone-trough,

full of water, that stood in a pasture-field, for the use of cattle. A number of Leeches (*H. sanguisugæ*) inhabiting the spring that supplied the trough, came and surveyed the Tench, and at length affixed themselves to different parts of its body. So effective was their hostility, that the Tench was quickly deprived of life. They then tore it (previously breaking the line of connexion between the various parts of the body, by inflicting a vast number of bites or wounds) into such pieces as they could readily receive into the stomach. So diligent and persevering were they, that in a few days nothing but the mere skeleton of the fish remained.*

A circumstance of a similar nature is also recorded by Klein.†

* Essay on the Philosophy, Study, and Use of Natural History, p. 222.

† "Ante aliquos annos in fundo meo civitatis inferioris *Cyprinos breves* sive *Carassos* in Fiscella servaveram, quos omnes post triduum ab *Hirudinibus* consumptos inveni, non nisi sceletis superstitibus." *Herpetalogia*, p. 66.

It would be useless to bring forward any more experiments. I shall only observe, that I have varied them in every possible shape, and have obtained from them this information :

1st, That the Medicinal Leech takes no kind of solid food.

2dly, That in its native abode, it lives by adhering to and sucking the fluids of fish, frogs, &c.

3dly, That its desire for food is not marked by that voracity which distinguishes the Horse-Leech.

4thly, That it does not display the same propensity to destroy its own or any other species of the genus to which it belongs.

In regard to the Horse-Leech, we must remark,

1st, That it destroys for food, the *H.*

medicinalis, the *H. vulgaris*, and shews as little mercy to the weaker of its own species.

2dly, That this *unsocial* propensity appears to be put in force in the absence of other food.

3dly, That it will swallow almost any thing presented to it.

4thly, That the name of *H. Vorax* is more expressive of its real character, than that of *H. Sanguisuga*.

Like the Hydra of ancient times, Leeches are stated to have the remarkable property of reproduction. Dr. Shaw observes that this is very conspicuous in the smaller kind of Leeches, the *H. stagnalis*, *H. complanata*, and *H. octoculata*; in which animals it almost equals that of the Polype. The doctor's experiments were made in 1773. To use his own words, "These animals were divided in every possible direction; and

the divided parts, after reproduction, were again sub-divided and again reproduced, without the failure of one single instance."* These experiments I have repeated, but with this wide difference, that I met with a failure in every instance. Let facts speak for themselves.

June 29th, I divided four Leeches (*H. octoculata*), each into two equal parts. Four of these parts preserved their vitality till September 3d. During the whole of this period, the only change noticed was, that the angles of the divided extremities were less acute: not the slightest tendency was evinced towards reproduction.

July 14th, three of the *H. complanata* (now *G. tuberculata*) and the same number of the *H. stagnalis* (now *G. perata*) were divided each into two equal parts. Those of the *H. stagnalis* lost their vitality in ten days. The vitality of the divided portions of the *H.*

* Linn. Trans. v. i. p. 95.

complanata continued until the 6th of September, but with a result similar to that which attended the division of the *H. octoculata.*

June 29th I took two Horse-Leeches, and cut off the head of one, and the head and tail of the other. These Leeches I have still by me (December 12th); but I cannot trace in either the slightest tendency towards reproduction.

I treated also, after the same manner, Medicinal Leeches, and with a similar result.

Many, says Müller, might be easily led into an idea, that an animal whose members when separated possess for a great length of time their vitality, is capable of reproduction; but, he judiciously adds—aliud enim est vitam in singulis partibus aliquamdiu remanere, hasque se movere; aliud in totidem abire animalia: illud pluribus animalium commune est, hoc minus vulgare.*

* Hist. Verm. 1774, p. 9.

In another place this author observes, what is more to the point, that he has endeavoured to ascertain how far this power of reproduction in Leeches exists; but all his experiments go to prove that Leeches have no reproductive power whatever.*

The Leech is reported, in common with other animals, to be infested with lice. I mention this on the authority of Klein,† never having myself witnessed them.

We come now to that part of the Natural History of the Leech which is the most intricate to develope; its mode of propagation, and the duration of its life.

In confinement, it is a very rare occurrence

* "Plurima (HELMINTHICA) per partitionem naturalem et artificialem transversam propagantur; utramque in *Hydris, Naidibus,* et *Lumbricis,* ego et ante me alii docuere; artificialem in *Hirudinibus* vero, et *Gordiis* frustra tentavi." —*Hist. Verm.* 1774, p. 9.

† Klein's Herpetalogia, p. 66.

to find Leeches propagate. From what particular cause this arises, it would be difficult to determine; although it may be in all probability the want of their proper nidus, the bottom or sides of pools. Notwithstanding that Leeches seldom bring forth their young in confinement, they still have been seen, as will be presently noticed, in *actu coitus*. It is rather singular that many insects which produce their young in confinement, will not copulate in that state; for instance, the Queen Bee. The fœcundation of this insect will never, according to Huber, take place in the hive, although she is surrounded by males; but if, says this accurate observer, she be allowed to escape from the hive, she then mounts high in air, and there the nuptial rites are celebrated.*. The female Ants, on the authority of several eminent naturalists, are obliged to leave the

* See Huber's interesting Remarks on the Impregnation of the Queen Bee.

ant-hill previous to fœcundation; but as soon as this state is accomplished, they return to their nest, and are so busied in depositing their eggs, that the desire of undertaking any more ærial excursions is entirely suppressed. Their wings, hitherto useful, but now only an incumbrance, they soon destroy; a fact often witnessed by M. P. Huber, son of the ingenious physiologist above alluded to.*

That the Leech has been seen in *actu coitus*, the following instances will, I trust, satisfy the most scrupulous. To this state Mr. Hebb, surgeon, of Worcester, has been more than once a witness. The Leeches, he informs me, were in full size and vigour; but he is acquainted with no instance of this union being productive. Mr. Evans, druggist, at Worcester, has also seen them in *actu coitus*,

* For some interesting particulars relative to the several species of Ants, I refer my reader to the recent publication of M. P. Huber, entitled *Recherches sur les Moeurs des Fourmis, &c.*

but only once. They were what are called the Trout-Leeches *(H. troctina)*; and he remarks that a double copulation, similar to what happens with the Garden-Snail, was then going forward. Of this union Mr. Hebb was also a witness: he made a memorandum at the time respecting it, and informs me, it is the only instance he is acquainted with, of a double copulation.

A question has arisen among naturalists, whether the Medicinal Leech is oviparous or viviparous. But previously to our entering upon this enquiry, an account will be given of a few animals that bring forth *both eggs and living young.*

The Plant-Louse, particularly that species found on the rose-tree, is said to be *viviparous in summer* and *oviparous in autumn.** . A circumstance so extraordinary,

* Shaw's Zoology, vol. vi. p. 168. Also, Introduction to Entomology, by Kirby and Spence, vol. i. p. 174.

as may well be supposed, excited no small degree of attention. It was at first doubted; but at length Trembley, Bonnet, Reaumur, and Lyonnet, stepped forward to bear witness to its truth. Of what Dr. Wm. Richardson has advanced on this very curious point, I shall now avail myself, trusting that its interest alone will be a sufficient apology for its present introduction. This gentleman states, that at the beginning of February, if the weather happens to be warm, small *Aphides* are frequently to be found upon the buds of the rose-tree, which are no larger than the young ones in summer, when first produced. But as there were then no old ones to be found, which in summer he had observed to be viviparous, he was exceedingly surprised, and almost induced to give credit to the old doctrine of equivocal generation. That the same kind of animal should at one time of the year be viviparous and at another time oviparous, was an opinion he could by

no means entertain; yet frequent observation convinced him that this was really the case. Those *aphides*, he remarks, that appear early in the spring, proceed from small black oval eggs,* which had been deposited in autumn. But what necessarily excites our surprise is, that all these should be females, producing about the month of April a very numerous progeny, and without having intercourse with any male insect. Five generations of these insects succeed each other during the spring and summer months, and would prove extremely destructive to vegetation, were they not now and then destroyed by the artifice of a very small black Ichneumon Fly, who darts its pointed tail into the body of the *aphides*, and there deposits its eggs, which at length producing worms, destroy the *aphides* as food.† From

* These eggs, when recently excluded, are green, but afterwards assume a deep black.

† Philos. Trans. Abridged, vol. xiii. p. 120.

Bonnet, who spent so much of his time in observing the habits of these insects, that, he he is said to have almost taken up his abode with them, we learn, that sexual intercourse takes place among the *aphides* only once a year. He took the *aphides* when first produced, and kept each individual separate. All the females brought forth young. These he kept individually apart, as in the former instance, and with the same result. This happened even to the ninth generation.

The *aphides*, as already stated, are oviparous and viviparous in the same year; but this, Mr. Curtis observes, in his interesting paper on these insects*, is not the case with all of this genus; for he remarks that the *Aphis Salicis*, from the 24th of September to to the 6th of December following, during which time Fahrenheit's thermometer was as low as 29°, was constantly viviparous. Other *aphides*, he remarks, are oviparous or

* Linn. Trans. vol. vi. p. 78.

viviparous according to the temperature of the air to which they are exposed. In very cold weather they are oviparous, for this obvious reason: the eggs are capable of resisting cold more powerfully than the young. On the 22d of November he found, without doors, on some auricula plants, the eggs of a small green *aphis*, while the same species, on a geranium that he kept within doors, produced young.

The common Wood-Louse (*Oniscus asellus*) is sometimes seen to produce eggs; at other times, young, perfectly formed.

Redi, in a work upon the generation of insects (Esperienze intorno alla Generatione Deg 'l Insetti), mentions that some flies are viviparous, others oviparous only; adding, that *the same flies* sometimes breed live worms, at other times lay eggs; and this he says is determined by the greater or less heat of the season.

From the evidence here adduced, may not

the conjecture be regarded as plausible, that the Medicinal Leech is, under certain circumstances, both oviparous and viviparous? If this be admitted, it will serve to reconcile the several statements, contradictory as they are, which follow.

A scientific friend of mine, who resides in the neighbourhood of Kenfig in Glamorganshire, made several enquiries for me, during the last summer, among those whose employment was the collecting of Leeches from the very extensive sheet of water at that place, relative to the habits, &c. of the Medicinal Leech. From his letter, now before me, I learn, that they bring forth their young alive; that the young are exceedingly small, of a white colour, and very numerous; that they assume their general colour in the course of a few months; that they are five years in attaining to their full growth; and that they

have been known to exist a period of at least twenty years.

Mr. Baker informs me, that he received in the month of July, from Thomas Webb, a leech-gatherer who resides in the Moors, near Glastonbury, one hundred large Medicinal Leeches, which were immediately placed in a tin canister containing water. On the following day, he was surprised to find among them several small Leeches, in active motion, appearing as so many dark-coloured threads. It might be supposed that ova, or even young Leeches, were present, without being noticed; but this, Mr. Baker contends, is unlikely, observing, that the Leeches were placed in a tin canister containing water only.

This is one of the few instances that have come to my knowledge, of the Medicinal Leech bringing forth its young alive; and it would have been an injustice towards Mr. Baker, who is firmly of opinion that the

Medicinal Leech is viviparous, to have suppressed it.

Indeed the collected testimony of the leech-gatherers amounts to this,—that the Medicinal Leech brings forth its young alive; but on their opinion we must not place too much reliance, since they are by no means accurate observers of Nature.

Horn also remarks, that they are viviparous, and produce their young, capable of acting in every respect as the parent animal. This, he observes, takes place in the months of April and May, the latter end of August, and in September.

Durondeau is led to the supposition of their being viviparous, from the structure of the womb, and the largeness of the genital organs.

M. Thomas, a recent French writer, remarks, that in the vessels where Leeches are confined, there are often discovered, towards the end of summer, small filiform Leeches.

Had these, he says, been placed in the vessel at the same time with other Leeches, they could not have remained concealed. Desirous of ascertaining if the Medicinal Leech produced ova, this author was at some pains to examine the water, each time it was changed, to discover, if possible, any germ of a future Leech; but without success. If the Leech, he adds, is oviparous, how can we reconcile the fact of filiform Leeches being found in a vessel, the water of which was renewed every day?—and how happens it that we cannot find the ova in water which has been preserved for a very long period? Not having ever seen these ova, he pronounces it as his opinion, that the Medicinal Leech is viviparous.*

Linnæus, it has been asserted, embraced a similar opinion. This celebrated naturalist, it is true, said that the *H. octoculata (H. vulgaris)* was viviparous, but never so

* Memoires sur les Sangsues, p. 107.

expressed himself in regard to the *H. medicinalis*. When Bergmann observed that the *coccus aquaticus* was the ovum or egg of this animal (*H. vulgaris*) producing from one to ten young, Linnæus, who had formerly denied this fact, was struck with astonishment; and when the proofs in support of it were given him, *vidi et obstupui* were the words he is said to have uttered, and which, in giving his approbation, he wrote down at the foot of the memoir.*

With respect to my own opinion, I believe the Medicinal Leech to be oviparous. The ova it produces are, I think, but few in number, and are either deposited in the bottom or banks of pools, or agglutinated to the roots of aquatic plants. About the latter end of April, in changing the water in which were a few Medicinal Leeches, I observed an ovum attached to the side of the glass-vessel. This ovum was preserved many months, but

* Dictionnaire Naturelle, 1791; art. *Sangsue.*

it proved unproductive; which was the case, as before remarked, with the ova of the *H. vulgaris*, produced in confinement. In its figure, it resembled the ova of the *H. vulgaris*, but was in size much larger, and corresponded to the character given by M. Virey; who states that the eggs of the Medicinal Leech are, in shape, semi-oval, have a shell or crust of a brown colour, and are transparent.*

In one of our modern Pharmacopœias, the Leech is also said to be oviparous, the ova being deposited in one involucre or covering, near the margin of pools, and hatched by the heat of the Sun.† I should suppose, from a note subjoined, that this information was derived from Mr. James Dickson, of Covent-Garden, who is stated to be well acquainted with the natural habits and œconomy of the Leech. I wrote, in the early

* Journal de Physique, tom. iv. p. 409.

† Lond. Pharm. by A. T. Thomson; art. *Leech.*

part of the spring of this year, to that gentleman, soliciting further information; but I regret to observe that I received no answer.

Mr. Hebb has seen, in the month of May, protruding from the female organ of generation in large Leeches, a white opaque oval substance, which he conceives to be an ovum. That the contents of these ova are not evolved may, he says, depend upon the absence of that just temperature and direct influence of the Sun which may be necessary to produce such evolution.*

The Leech is very tenacious of life. To the experiments already mentioned, of its living several months without either the head or the tail, I shall now add those, in which it has been subjected to the Air-Pump, and to the influence of several kinds of gas.

A Leech was put into a glass vessel containing a little water, and placed under an

* Encyclop. Lond. art. *Hirudo.*

air-pump. The air was then exhausted. The Leech was kept under the exhausted receiver five days, without suffering much inconvenience, being nearly as lively on the admission of fresh air, as when first subjected to the experiment.

Durondeau kept eight Leeches under an exhausted receiver for eight days. All this time, he says, they suffered very little from their confinement. The same writer found that a single Leech, subjected to a similar experiment, lived until the twenty-third day.*

The following animals were put into separate glass vessels, each filled with a pound-weight of distilled water, and the vessel inverted upon quicksilver, viz. one Gold-Fish, one Frog, *two Leeches*, and one fresh-water Muscle. The Frog died on the third day, the Fish on the fifth, *the Leeches on the eighth*, and the fresh-water Muscle on the thirteenth.†

* Journal de Physique, 1782; p. 289.

† Philos. Trans. 1805; pt. i. p. 16.

The Leech will live for a considerable period in the different kinds of gas. I found them to live in a glass vessel containing

Three cubic inches of Hydrogen Gas, ...		2 days	12 hours.
.....	Carbonic Acid Gas,	0	5
.....	Nitrogen Gas, ...	8	0
.....	Atmospheric Air, ..	10	0
.....	Oxygen Gas, ...	12	0
.....	Water strongly impregnated with Carbonic Acid Gas, ...	0	4
.....	Olive-Oil, ...	1	16
.....	Spring-Water, the vessel being well corked, ...	7	0

I shall now cite one or two experiments made by Bibiena. Three Leeches were placed in a tin case well closed, which was covered with a quantity of snow, into which were thrown some handfuls of common salt. In two hours the Leeches were so hardened, that neither the effect of a mild heat, nor that of water at a moderate temperature, could produce any sign of life in them. This

experiment proving fatal, Bibiena repeated it, surrounding the tin case with snow only. In four hours the Leeches appeared a little contracted, but not at all frozen; and on being thrown into pure water, soon resumed their usual activity.

We shall now bring the Natural History of this very singular animal to a close, by offering a few observations on the duration of its life.

The Leech, it appears, has lived in confinement eight years. I learn that a medical practitioner at Bridport once preserved two Leeches alive during this period; and that three or four were lately in the possession of a gentleman of Glastonbury, who had then kept them for five years.

These gentlemen, it is probable, had the Leeches when fully grown; and the time before they could arrive to this state being considered with the time they were kept in confinement, we have the strongest reason for

believing that the Leech will live in its native waters, where it can always meet with an abundant supply of food, a period of at least twenty years.

The following instances of the extreme slowness of its growth, cannot but be admitted as valid proof of its being long-lived, conformably to the general law, that the longer the time an animal takes in arriving to maturity, the greater is the duration of its life.

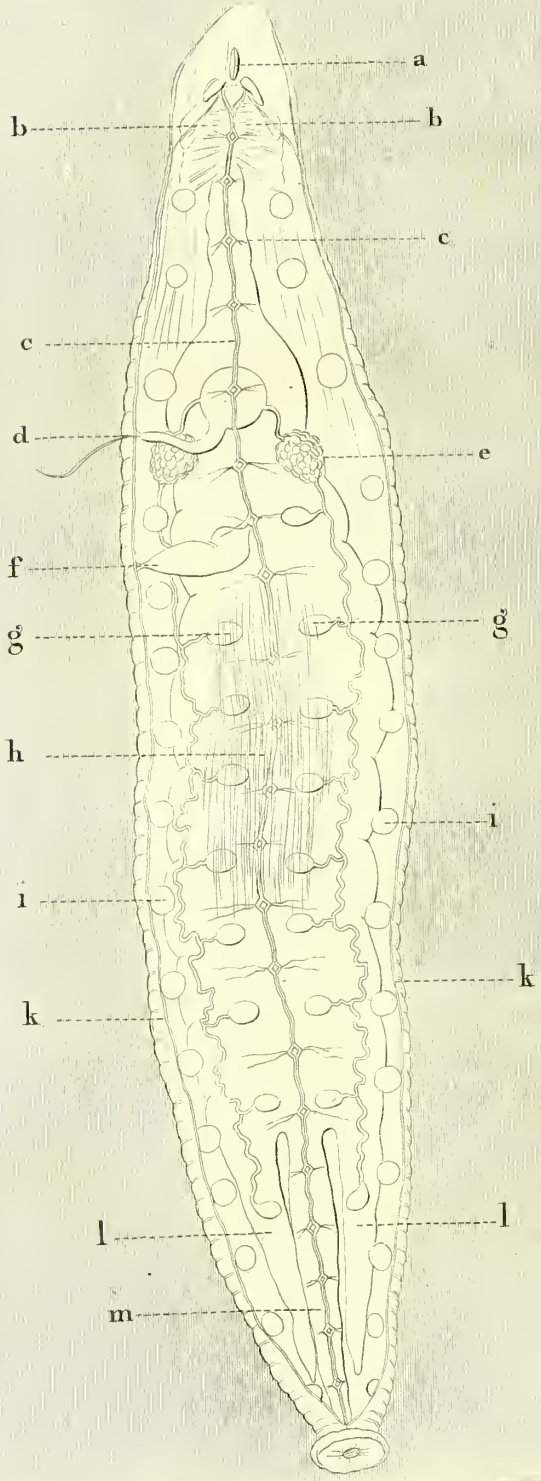
Mr. Hebb subjected to the balance, in July 1808, the smallest Leech he ever saw, and found it to weigh half a grain. It died, owing to severe frost, the December following, but had acquired no additional weight.*

M. Thomas placed in a bottle, four young filiform Leeches. Two months elapsed before there was even a slight increase; their bodies were still small at the end of the ninth month.†

* Encyc. Lond.; art. *Hirudo.*

† Memoires sur les Sangsues, p. 121.

We therefore necessarily arrive at the conclusion, that the Leech is a long-lived animal; but to determine with precision the exact number of years, is a point to which, from our present limited information, we cannot possibly attain.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SECTION THE THIRD.

The Anatomical Structure of the Leech.

IN this section we shall first treat of the *external structure,* then of the *organs of the senses* and the *respiratory organs,* and lastly of the *internal structure,* which will be found to merit our notice on account of its great singularity.*

* As the references will only apply to the annexed outline, we shall here give an explanation of the Frontispiece.

Fig. 1

Represents the internal structure of the Leech, slightly magnified. At the superior part we notice the piercers, improperly called the teeth, and the male and female organs of generation; at the inferior parts, the two last long cells or stomachs, and the intestine. The abdominal blood-vessel is seen taking a direction from the mouth to the anus, forming several diamond-shaped expansions in its course. We find on each side of this vessel, the cells or stomachs ranged in

THE EXTERNAL STRUCTURE.

The body of the Leech is elongated, round, more or less flattened, tapering towards the extremities, and composed, after the manner of the Earth-Worm, of a number of rings.

The mouth, or that portion formed by the upper and lower lips, usually presents a circular or rather a horse-shoe shape, and is employed by the Leech as a sucker, to attach itself to surrounding bodies.

At the anal extremity is another sucker,

regular order. To the surface of each is attached a small oval-shaped body, forming a connexion, the one with the other by means of a tortuous tube.

Fig. 2

Represents, under a highly magnified form, the body of the male generative organ, with the penis hanging from its sheath. The uterus with the ovaria and the testes.

Fig. 3

Represents a dried preparation, shewing a few of the cells distended with eommon shot, and a portion of the intestine in which a slip of wood has been inserted.

broad and circular, answering the same intention.

There are two openings in the belly, termed generative.

There is also an opening at the lower part of the back, termed the anus.

The body of the Leech, in a state of rest, is of an arched form, and about an inch or an inch and a half in length; but when in motion, may be extended to four, five, or even six inches.

In regard to the number of *rings* or *annular muscles* with which the body is furnished, we are told that it increases with the age of the Leech. This is, however, incorrect; for I have counted, in a very young Leech, as many rings as we are accustomed to meet with in an old one of the largest size —usually about one hundred. It therefore appears, that as the age of the animal increases, there is an augmentation of the rings

in size only, and not in number. On the most prominent part of each ring, there is a row of minute tubercles.

The mouth is, as before noticed, of a circular or horse-shoe form, but from the great extent of motion the lips possess, may be made to assume whatever figure the Leech finds most convenient. The external surface of the mouth is of a dark grey, and the internal of a light grey colour. The upper lip is lightly bent downward, having something like a cleft in the middle. The lower lip is bent inward, and like the upper lip, is in form semicircular. When these lips are attached to any foreign body, the strong muscular apparatus in the upper part of the œsophagus is brought into action, and by enabling the Leech to form a vacuum, renders its attachment the more secure.

The sucker at the superior extremity, or what properly speaking constitutes the mouth, consists of several fasciculi of muscular fibres.

The sucker at the inferior extremity, consists also of an assemblage of muscular fibres. Some pass from a central point towards the circumference, whilst others interlace these and dispose themselves circularly.

The first foramen, or opening in the belly termed *generative,* is round and small, situated at about half an inch from the lower lip. From this foramen the penis issues. The Ancients entertained the idea of its being serviceable to the Leech for breathing. At this opinion I feel little surprise, having never witnessed the penis hanging from its sheath in the living Leech, although in the dead Leech this is so frequent an occurrence, that it cannot, I should think, have escaped the notice of the most cursory observer.

At a little more than a quarter of an inch below this first foramen, or at the distance of five rings, we find *a second foramen,* termed *the vagina.* This leads to the uterus, and is seldom seen unless closely inspected.

The foramen termed *the anus* is situated on the back, a little above the circular sucker terminating the lower extremity. This foramen appears to have been but little understood. Morand denies its existence, positively asserting that the Leech has no opening which can supply the place of an anus,* nothing passing off but the glutinous matter so generally distributed over the surface.†

Dumeril steps forward in support of this idea, ‡ which I am surprised to find is also countenanced by the justly celebrated John Hunter; who, in his postscript to the description of a new marine animal (*Amphitrite Volutacornis*) brought from Barbadoes by

* This idea may probably have been derived from the following passage in Pliny: "Est animal, infixo semper sanguini capite vivens, atque ita intumescens, unum animalium cui cibi non sit exitus: dehiscitque nimia satietate, alimento ipso moriens."—*Hist. Nat.* tom. 1, p. 611.

† Memoires de l' Academie Royale des Sciences, 1739; p. 261.

‡ Zoologie Anatique, p. 298.

Mr. (now Sir) Everard Home, says, "It is very singular that in the Leech, Polypi, &c. where no inconvenience can arise from having an anus, there is not one; while in this animal, where it would seem to be attended with many, we find one; but there being no anus in the Leech, Polypi, &c. may depend upon some circumstance in the animal œconomy which we are not at present fully acquainted with."*

These writers, and others who have implicitly followed them, appear to have taken little or no trouble to ascertain how far their assertions were well or ill founded. Had this been the case, the error would, I am well persuaded, long since have been discontinued. Indeed a single dissection of the Leech would have shewn them upon what a slight foundation their remarks had been built.

Cuvier, whose observations are for the most part drawn from what he had himself seen,

* Phil. Trans. Abridged, vol. xvi. p. 5.

remarks that the Leech has an anus, but so small as to have been frequently overlooked; hence the belief has gained ground, of its non-existence.*

Poupart, in describing the Intestine of the Leech, under which name he includes what I have thought fit to distinguish by the term *Alimentary Canal*, says that it proceeds in a straight line from the mouth to the anus (en ligne droite depuis la bouche jusques a l'anus), and is of the thickness of a common quill.† He makes no other mention of the anus than in this general way; but this is sufficient to convince us he was thoroughly aware of its existence.

Virey and Thomas, two respectable French writers, and Blumenbach, the celebrated German physiologist, have made observations to the same effect.‡

* Leçon's d'Anatomie Comparèe, tom. iv. p. 141.

† Journal des Sçavans, 1697; p. 538.

‡ Memoire sur la classe des Vers, par J. J. Virey; Journal

"The readiness," Sir Everard Home remarks, "which the Leech possesses of disgorging itself, has led into the general mistake of its having no second opening by which the contents of the stomach may be evacuated."*

I have been thus minute in giving the opinions of various authors concerning this foramen, in consequence of my finding its existence still denied, in publications of recent date; but if any further proof be required, I have only to observe, that I have several times injected a fluid, from the mouth of the Leech, so as to flow out in a continued small stream through this very opening. And to make it the more satisfactory, I have reversed the experiment, by employing a glass tube,

de Physique, tom. iv. p. 438. Mem. sur les Sangsues, par M. Thomas, p. 49. Comparative Anatomy by Blumenbach, translated from the original German by Lawrence, p. 176.

* Home's Lectures on Comparative Anatomy, p. 366.

drawn out to a very slender point, and inserted into this identical foramen. Through this I have forced an injection, and thus filled the whole of the internal cavity.

This foramen or *anus* lies immediately above the rim of the circular sucker at the inferior extremity, and is large enough to admit a common-sized pin. In the dead Leech it may be discovered with the utmost readiness. This foramen is so much larger in the *H. sanguisuga* than in the *H. medicinalis* or *H. troctina* (a wise provision of Nature, for allowing a quick removal of the fœcal matter so soon generated in this species, on account of its great digestive powers), that by slightly pressing the lower part of the body, fœculent matter will almost to a certainty escape, and thus remove every doubt of its existence.

Before we enter upon the consideration of the internal structure of the Leech, I have thought fit to notice what appertains to the organs of sense; and first of

The Organ of Vision.

The eyes of the *H. medicinalis*, *H. sanguisuga*, *H. troctina*, and *H. nigra*, are ten in number, ranged under the form of a crescent at the pointed extremity on the back part of the head.

The two eyes on each side terminating the border of the crescent, are placed at greater distances from each other than the rest. All the eyes under the field of the microscope, appear as tubercles jutting forth from the skin. They are of a deep black, and when moistened, have a fine glossy lustre. I must here observe, that when the head is much

contracted, they cannot be seen. It is necessary to be acquainted with this circumstance, or we might conclude, from an imperfect inspection, that they are wanting. Besides, the head being itself of a dark colour, they are likely to escape notice; hence the inspection should take place under the favourable circumstance of a strong light. When the head is fully expanded, and the lips firmly applied to any surrounding body, the eyes may be readily observed; and should the Leech have just quitted the water, they become, from the bright and vitreous appearance they then assume, evident to the naked eye.*

The Organ of Touch.

The organ of feeling, or of touch, resides

* Those who wish to have preparations of these organs, may readily form them, by cutting off the head of the Leech, and subjecting it, between two strong plates of glass, to continued pressure. In this way I have made dried preparations of the organ of vision in the different species of Leeches that have fallen under my notice.

in the lips, and according to Cuvier, even in the disk that terminates the lower extremity.

The Organ of Taste.

In considering the avidity of the Leech for blood, we are quickly sensible of its possessing an organ of taste, which we find situated in the upper part of the œsophagus, and composed of an assemblage of nervous fibrillæ.

The Organ of Hearing.

The closest anatomical inspection does not advance us a single step in determining the situation of this organ; but there can be no doubt that it is granted to the Leech, in common with the numerous tribe of animated beings.*

* It may not be foreign to our subject, to remark that the organ of hearing has not been yet discovered in the common Bee, although we are furnished with sufficient proof of its existence; for when, as Huber informs us, the imprisoned Queen Bees desire their liberty, they emit those

The Organ of Smell.

If the Leech breathes, as I am firmly of opinion it does, by puncta respiratoria, or breathing-holes, the organ of smelling will be there found to exist, in accordance with the idea of those naturalists, who suppose the stigmata of insects to be the true organs of smell.

THE RESPIRATORY ORGANS.

We now come to the respiratory organs, regarding which there are two opinions: one, that the Leech breathes by the mouth; the other, by stigmata or breathing-holes.

sounds which, to the common working-bees, indicate this wish; who in consequence destroy the cells, thus favouring the escape of the royal recluse. The noise or humming made by the Female or Queen Bee, just as the Bees are going out to swarm, is nothing more, says Swammerdam, than an expression of joy, at the excursion she is about to make; and this is doubtless heard by, and animates, the whole group.

Those who embrace the former opinion, retain it with the more confidence, from knowing that a Leech will live several days in oil; this fluid proving destructive, if poured over the body of those animals that breathe by spiracula. To determine how long a Leech would live in oil, I subjected one to the following experiment.

In a small phial, filled with the best olive-oil, I placed an exceedingly lively Leech. It at first appeared very little incommoded by its imprisonment, but in a few hours was seen to have that hurried or waving motion which we frequently observe among Leeches when there is any sudden change in the atmosphere, evidently with a view of extricating itself from its situation, which was then becoming unpleasant. This waving motion was continued at intervals the whole of the first day. During the early part of the second day, the Leech kept firmly attached, by both of its extremities, to the sides of the

vessel, and remained motionless. In forty hours from the commencement of the experiment, it became languid, relinquished its hold, and shortly afterward died.

That the Leech should thus live two days in oil, is, we cannot but admit, in favour of the opinion of its breathing by the mouth; and to this opinion I might lean, had I not ascertained by experiment, that a Leech will live as long a period, that is, two days, with a ligature drawn around its head so tight as to preclude the possibility of its receiving air by this aperture.

The Earth-Worm, it is well known, breathes by spiracula; and yet Redi remarks that he once kept two immersed in oil for twenty-four hours, placing them afterward in a vessel with moistened earth. The one survived the experiment three, and the other six days. "In duo vasa oleo plena immersi crassos duos Lumbricos, qui ibi viginti quatuor horas manserunt, licet torpidis-

simi viderentur. Eos extra oleum edux liberosque reliqui in vase terra humida pleno, ubi unus tertio die interiit, alter vero ad sextum usque diem vixit, quamvis semper torpidus, vixque vivus videretur. Unde concludere licet, oleum quantumvis *lumbricis* noxium sit, iis tamen non esse potentissimumque venenum, ut revera solet esse permultis insectorum generibus, sicut Muscis, Vespis, Apibus, Limacibus nudis, Bombycibus, *Sanguisugis*, permultisque aliis hujusmodi animalculorum generibus."* From this passage it appears that Earth-Worms are less affected by being placed in oil than Leeches. This, though not strictly correct, may yet approximate to the truth; and so far the argument, on which great stress has been laid, that Leeches do not respire by spiracula, on account of their living in oil, is rendered in some degree inconclusive.

To determine, however, the accuracy of

* De Viventibus intra Viventia, p. 153.

this experiment, and how far it may be relied on, I placed three middle-sized Earth-Worms in the phial in which I before imprisoned the Leech, removing them at the several periods of twelve, twenty-four, and thirty-six hours, and transferring them to a vessel filled with humid earth. In a short time, symptoms of vitality were evident in each, particularly toward the extremities; which excited an idea of their speedy recovery. In this respect I was deceived: that which had been immersed only twelve hours survived the rest, but in a state scarcely to be called living, about two days.

The membranous sacs or bladder-like bodies which M. Thomas conceives are the true respiratory organs in Leeches, and which occur on every fifth ring, are, in fact, the bodies that contain the unctuous fluid for lubricating the surface, and will fall under our consideration in a

subsequent part of this section, under the name of *lateral vesicles*. In justice, however, to this author, I transcribe the passage in which these bodies are alluded to. "Bientôt, dans une dissection plus attentive, je remarquai qu'il y avoit à certaines distances, sur les deux côtés du corps de la Sangsue, des espèces de sàcs membraneux, transparens, en forme de vessie, qui étoient renflés, et ne paroissoient contenir que de l'air. J'observai la distribution qu'ils présentoient, et je reconnus qu'ils étoient placés d'une manière régulière sur les deux côtés de l'animal. Ils existent depuis la bouche jusqu'à l'origine du disque, et sont assez rapprochés l'un de l'autre. Je me rappelai alors que j'avois vu, à la peau, des trous plus grands que les autres, d'où il m'avoit semblé que s'échappoient des bulles d'air, et d'où j'avois vu sortir des gouttes d'un liquide blanchâtre. Je les examinai de nouveau, et je trouvai, comme je l'ai déjà dit, qu'il y avoit entre chacun de ces

trous l'intervalle de cinq anneaux. Il étoit probable que c'étoit comme autant d'ouvertures qui conduisoient aux corps en question. J'y fis en effet passer une soie de cochon, et j'arrivai directement dans ces corps."* These bodies, he observes, in conclusion, are the true organs of respiration in Leeches.

Cuvier, in describing the lateral blood-vessels of the Leech, has thus expressed himself: "Il y a de chaque côté, un gros vaisseau longitudinal, qui communique avec son oppose, par beaucoup de vaisseaux transverses, formant deux reseaux a mailles rhomboidales dont l'un du cote du ventre. Il faut que les rameaux de ce reseau, qui s'epanouissent a la surface de la peau, servent a la respiration de l'animal, car il n'a point d'autre organne, pour cette function."†

We may add, in support of the Leech

* Memoires sur les Sangsues, p. 70.

† Leçon's d'Anatomie Comparée; tom. iv. p. 413.

breathing by spiracula, that small globules of air are frequently seen to escape from the surface of the body, when the Leech is about to cast off its scarf-skin; which operation is greatly facilitated by the passage of a column of air between the body and epidermis.

From a review of these statements, we are authorised, I think, in concluding that the Leech breathes by spiracula or breathing-holes, and not by the mouth.

THE INTERNAL STRUCTURE.

Besides the *epidermis* or outer covering, the coats proper to the Leech are the *cutis*, the *muscular coat*, and the *membranous coat*, with intervening *cellular substance*.

If an incision be made on the belly of the Leech, and carried in a straight line from the mouth to the anus, but not so deep

as to penetrate into the alimentary canal, we bring into view—

The three piercers (a), incorrectly denominated teeth.

The nervous mass surrounding the œsophagus, or what constitutes the *brain.*

The abdominal blood-vessel (cc) passing from the head to the tail, having several diamond-shaped expansions in its course.

The lateral blood-vessels (kk).

The male organ of generation (d).

The female organ of generation (f).

The testes (e).

The abdominal vesicles (gg) lying on the surface of the several cells or stomachs.

The lateral vesicles (ii) containing the unctuous fluid for lubricating the surface.

Continuing the incision into the internal cavity, we meet with—

The œsophagus.

The stomach, divided into several compartments or cells.

The alimentary canal.

The intestine (m).

The Epidermis.

The epidermis or outer covering of the Leech, is a thin fibrous reticulated membrane. It is thrown off from the body every four or five days, and often seen floating in the water under the form of a little ring.

The Cutis.

The cutis, on an external view, seems to be a dense and firm membrane; but internally it presents a flocculent appearance. Its texture is spongy. It is firmly attached to the muscular coat, lying beneath, particularly in the intervening space of each ring, where it loses much of its flocculent appearance.

The Muscular Coat.

The muscular coat, which is of an ash-grey colour, consists of two layers of fibres, disposed circularly and longitudinally. The longitudinal layer (h) is very conspicuous. These two sets of fibres interlace each other, and cannot, without deranging their structure, be separated. They possess great strength and elasticity, enabling the Leech to perform with facility all its varied movements.

The Membranous Coat.

The membranous coat is extremely delicate. It forms a lining to the whole internal cavity, and viewed by the microscope, appears like fine lace.

The Piercers.

The piercers (a), improperly termed teeth, have a rounded form, with sharp cutting edges. They are three in number, and

cartilaginous. They rest on small eminences, and are so placed in regard to each other, as to meet in a centre under equal angles. They are confined in their relative situation by a strong circular ligament, which surrounds the œsophagus.

The wound which the Leech inflicts has been compared in figure to that occasioned by a three-edged sword or dagger, such as is called by the Italians *estocado ;* and is attributed by Poupart, not to the introduction of the piercers, but to the force of suction alone. " Lors que la Sangsue," he says, " aplique la bouche sur la chair de quelque animal, tous ces muscles* venant á se contracter, elle l'a suce avec tant de violence et d'avidité, qu'elle la fait entrer en forme de petit mamelon jusques dans sa gorge : de sorte que tout l'efort de la suction se terminant dans un

* Alluding to the several bands of muscular fibres in the throat.

fort petit espace, il faut necessairement que la chair se creve dans cet endroit: car il ne faut pas croire que la Sangsue la perce avec un eguillon, come l'ont ecrit plusieurs auteurs."*

With this opinion of Poupart, I was at one time strongly inclined to coincide, supposing it highly improbable that the wound could be produced by other means, more particularly as the piercers were only cartilaginous, and hence, one would imagine, little likely to form a puncture in a substance so dense as the skin. Touching upon this point in conversation with my highly valued friend Mr. William Swayne, we were anxious to ascertain whether the wound was produced by suction alone, or by the insertion of the piercers. Being provided with a middle-sized Leech, he applied it to his arm, and allowed it to remain affixed four or five minutes. The head was then separated,

* Journal des Sçavans, 1697; p. 537.

with a quick cut of the scissars, from the rest of the body, and as near as possible to the place of attachment. Notwithstanding this separation, the head continued strongly affixed, and the blood was pumped up for some minutes, owing to the strong muscular action that still centered in the œsophagus. The edge of a penknife was then applied to the lips, and they were carefully raised; when the piercers were found to be buried in the skin. This experiment was repeated, and with a like result. It therefore appears, that not only is the wound produced by the insertion of these piercers, but the piercers remain lodged in the skin during the whole of the operation. To penetrate the skin is, to the Leech, an office of some labour: it is not effected by merely thrusting forward the pierces with any force, but by constantly (aided by the power of suction which keeps the skin on the stretch) moving them backward and forward, scratching as it were the

cutis each time, and thus by degrees burying them in the skin. That the wound is not produced all at once, may be also fairly inferred, from the gnawing pain that continues for two or three minutes after the Leech has commenced its operations.

Whilst the Leech is in the act of sucking, the piercers, I should have before remarked, at that time stiffened, are in motion, being carried from side to side in an oblique direction. Their action may be seen by presenting to the Leech a coagulum of blood, and when the Leech is in the act of suction, cautiously removing it. For a few seconds it appears unconscious of its removal, which presents a fair opportunity of observing the oscillatory movement of each piercer.

The Nervous Mass or Brain.

The brain of the Leech is said to consist of a single nerve. This was the opinion of Mr. John Hunter; who, in his valuable

preparations of the brain of different animals, from their more simple state of organization to their more complex state, placed the brain of the Leech, consisting of a nerve only, at one end of the scale, and the brain of man at the other. Poupart and Cuvier, in describing the brain, speak also of this nerve; but it is sufficiently manifest, from their description, that they allude to the abdominal blood-vessel.

In those animals in which we vainly endeavour to discover a brain, the first ganglion that presents itself, or forms a collar to the œsophagus, is mentioned as not only supplying its place, but actually receiving its name. Thus, in the Water-Scorpion (*Nepa cinerea*), the nervous system consists of three ganglia; the first of which supplies the place of the brain.* And in the Sea-Mouse (*Aphrodita aculeata*) we find a large nervous

* Leçon's d'Anatomie Comparèe, tom. ii. p. 346.

ganglion, situated above the mouth, which is stated to be the brain.*

Surrounding the œsophagus of the Leech, we observe a similar mass or ganglion, from which issue nervous filaments, to the different parts of the body. This mass we shall therefore, according to established usage, denominate the Brain. From the brain proceed laterally two nerves, which go forward to the tail, here and there expanding in their course. To these must be added a central nerve, or that which occupies the middle line of the abdomen. As it regards this nerve, we notice this singularity, that it occupies the interior of the abdominal blood-vessel, or in other words, that this vessel forms its envelope. This nerve has several expansions or ganglia in its course, which assume the shape of a diamond, answering to the figure so frequently repeated in the abdominal blood-vessel.

* Leçon's d'Anatomie Comparèe, tom. ii p. 353.

The Blood-Vessels.

The vessels of the Leech, like those of the Earth-Worm and others in the same class, contain red blood. The abdominal blood-vessel (cc) which has been hitherto considered as the nerve or brain of the Leech, proceeds in a straight line from the mouth to the tail, and forms several expansions in its course, where it assumes the figure of a diamond. The first of these appearances is met with, a little below the lip; the second, at the commencement; the third, at the middle; and the fourth, at the termination of the œsophagus. The fifth is invariably seen upon the bag of the male generative organ. The rest observe regular distance, and terminate close to the disk at the inferior extremity. M. Thomas speaks of this vessel as a membrane between the nerve, but is unconscious of its being a tube that conveys the circulating fluid. Upon this point, however, I can

speak decisively, having several times seen the blood circulating in it.

Besides this abdominal vessel, there are two lateral blood-vessels and one dorsal blood-vessel.

The lateral vessels (kk) are, when the Leech is in motion, nearly straight; but when the animal is at rest, they give the appearance of a circle of festoons. The dorsal vessel, as its name implies, is situated upon the back, and passes in a direct line from the head to the tail.

The communication between these vessels is effected by a vast number of minute transverse branches, irregularly distributed.

In all these vessels I have, in my dissections of the Leech in its living state, seen a well-marked systole and diastole. The pulsations that occurred during the first minute were ten; the second minute, nine; the third minute, eight. From this period they became

irregular and indistinct, and the Leech died. On holding up the *H. vulgaris* to the light, these movements may be distinctly seen even with the naked eye, the pulsations being about eight in a minute. I have at different times placed the most transparent of the *H. vulgaris* under the microscope, but never yet could trace any central organ of the vascular system. We find, however, in a paper by Durondeau, that the Leech (*H. medicinalis*) is described as having a heart, which is said to be a fleshy pouch, in figure conical, but irregular; attached to the back by large vessels, but free and floating at its point.* A heart answering to this description I have never yet observed.

Sir Everard Home, speaking of the circulation of the Caterpillar, remarks that the blood is carried from one end of the body to the other by a species of peristaltic motion, in *a tube*, which may be either called *Heart*

* Journal de Physique, 1782; p. 287.

or *Artery*.* The heart of the Bee, according to Swammerdam, is *an oblong tube*, here and there dilated, extending in length *from one end of the body to the other*;† and in regard to figure, the heart of the Worm that produces the Gad-Fly nearly represents the worm itself.‡ The heart of the Silk-Worm is said to be single, and placed in the upper part of the body in the back; but Malpighius, who has written on the anatomy of this insect, says that it is possessed of more hearts than one. He doubtless considers each dilatation of the vessel as a distinct heart. The abdominal blood-vessel of the Leech presents also several dilatations: it therefore would appear that the Leech has a heart, or set of hearts, in common with other animals. "Nullum est animal," says Redi, "adeo

* Philos. Trans. 1813; Part i. p. 238.

† Swammerdam's Book of Nature, translated from the Dutch and Latin original edition, 1758; Part i. p. 202.

‡ Ibidem, Part ii. p. 50.

vile, parvum, minutum, et quasi invisibile, quod corde instructum non sit: omnibus, inquam, viventium, quæcunque sint, providentia divina cor largita est: imo et permultis insectis, non unicum concessit, sed unum in plurima parva corcula divisum."*

The Male Organ of Generation.

This organ (d), enclosed in a strong membranous bag of a circular form flattened both on its upper and lower surface, is a strong elastic tube, possessing great irritability. Its usual length is about one inch. In the dead Leech it is frequently seen hanging from its sheath.

The Female Organ of Generation.

The Uterus (f) is an oblong bag, formed somewhat after the manner of a bag-pipe. It consists of a strong membranous coat,

* De Viventibus intra Viventia, p. 91.

covered with muscular fibres, and is connected with the vagina, the foramen of which has been already described. It is endowed with a strong peristaltic motion, which is sufficiently evident in a Leech under dissection; and there is attached to its posterior part an oviduct, leading to the ovaria.

Each individual Leech, having both the male and the female organ of generation, is of course an hermaphrodite; but it remains a question as yet undecided, whether it is capable of self-impregnation. Bibiena, who was the first to notice this circumstance, observes that each Leech receives the embrace of another, and each becomes impregnated in turn. He is also of opinion that each Leech, singly and without the assistance of another, is capable of going through the generative process. "Primum itaque conjicio hermaphroditum hunc nostrum in illis esse numerandum, qui et cum aliis suæ specici

copulari possunt, et sibimet ipsis etiam conjungi, patris simul matris officio fungentes." Although a double copulation takes place, yet I cannot but think with Bibiena, that under certain circumstances, hermaphroditic impregnation may occur *in a single Leech*, and more particularly if by accident it be removed from any of its species.

The Testes.

On each side of the male generative organ is an oblong body, containing a thick fluid, in colour of a greyish white. These bodies I have named the Testes (e). From their appearance, they have been by some writers regarded as the brain. They are situated at the commencement of the first pair of cells or stomachs, and are furnished with tubes to convey the fluid they contain, into the bag of the male generative organ. Durondeau imagines these bodies to be nothing

more than fecundating vesicles.* In this respect I agree with him, but not in considering the bag containing the penis to be, as he asserts, the uterus or womb. To the penis, which we lately described, he gives no name, observing that it is not constant. In this, however, he is much deceived ; for I have in no instance missed finding it.

The Abdominal Vesicles.

Lying on the surface of the cells or stomachs, we meet with several oval bodies of the size and colour of mustard-seed, which from their situation and structure I term Abdominal Vesicles (gg). These vesicles contain the same kind of fluid as the testes, to which they are connected by a tortuous tube. They occur in pairs, the first of which is seen within a short distance of the testes. The other pairs observe regular distances

* Journal de Physique, 1782; p. 286.

and terminate about the middle of the last cells or stomachs.

The Lateral Vesicles.

The lateral vesicles (ii), as their name implies, occupy the sides of the body, are about thirty in number, and have been considered by M. Thomas as the true organs of respiration in Leeches. Sir Everard Home is also of this opinion.* But as far as I have myself remarked, they are not connected with this function; being, in fact, the bodies that secrete or contain the unctuous fluid for lubricating the surface. The unctuous fluid or slime, so generally diffused over the body of the Leech, is by a wise provision of Nature well adapted to guard it from

* Vide a paper by this gentleman in the Philosophical Transactions for 1815, Part II., "On the Structure of the Organs of Respiration in Animals which appear to hold an intermediate Place between the Class Pisces and the Class Vermes, and in two Genera of the last-mentioned Class."

the attacks of its enemies; from whom it readily escapes on account of its great slipperiness. This is sufficiently manifest in taking a Leech in the hand for a few seconds, when it covers itself with slime to such a degree, that it is only with the greatest difficulty retained. It also prevents water-insects from attaching themselves to the skin, and there depositing their eggs; and is undoubtedly of the highest importance in preserving the pliability and elasticity of the numerous rings, in the due extension and contraction of which the locomotive power of the Leech is lodged.

The Œsophagus.

The œsophagus is about a quarter of an inch in length. It is narrow at its commencement, then gradually widens, and again contracts on its reaching the first pair of cells or stomachs. It is furnished internally with several muscular longitudinal

plicæ or folds, which serve to regulate the pendulum-like movements of the piercers; and externally with several bands (bb), composed of strong muscular fibres.

The Cells or Stomachs.

The cells or stomachs,* or more properly speaking, one general stomach divided into several partitions, constitute about four-fifths of the body. The number of these cells is stated to be twenty-four; hence the Leech is said to have twenty-four stomachs. Of these cells I have never seen more than eighteen; but if we are to regard the two membranous folds in each of the last long stomachs as distinct cells, there will then be twenty-two.

* Sir Everard Home, in his late publication on Comparative Anatomy, gives a very correct delineation of these cells (Pl. LXX.), and also of the intestine. Durondeau has likewise presented us with a view of these cells, in an engraving accompanying his Description of the Leech, in the Journal de Physique, 1782; but it is extremely inaccurate.

The shape of all these cells is semi-oval, except the last, which is oblong. These are considerably larger than the rest (11), and terminate close to the anal extremity in a blind sac. The cells are all formed by a reflection of the membrane lining the internal cavity.

As the structure of this general stomach is so remarkably singular, I beg leave to point out one or two methods, by which its several cells or partitions may be seen to advantage.

Place a Leech, fully gorged with blood, in a saturated solution of corrosive sublimate in water. At the expiration of a week or ten days, make an incision from the belly into the alimentary canal, and pick out with a needle the contents of each cell. Or, fill the whole of the internal cavity, using a finely pointed syringe, with spirits of wine. In this state, let it remain four or five days; then make an incision; when the cells, from

being corrugated, will appear very conspicuous. Or, let the cells of a recently dead Leech be filled with mercury. This method has the advantage over those enumerated of shewing the precise figure of each individual cell. In the Frontispiece, fig. 3, these cells are represented distended with shot. This has given them a round appearance, dissimilar to their real figure, which is oval.

The Alimentary Canal.

The alimentary canal, a continuation of the œsophagus, is about the size of a crow-quill. It has openings on each side, communicating with and corresponding to the number of the cells or stomachs, and is furnished, throughout its whole extent, with membranous folds, having a small central opening, which, while they answer the purpose of valves, to prevent the return of

alimentary matter, retain the cells in their relative situation.

The Intestine.

The intestine (m) is situated between the two last long cells or stomachs. It is about an inch in length, generally filled with fœcal matter, and furnished with several plicæ or folds. It is confined in its situation by two ligamentous bands, which run at its upper part in an oblique direction. At its upper orifice we find a valve which prevents the return of fœcal matter into the alimentary cavity, and at its lower end a sphincter which prevents the blood, in an over-gorged Leech, from forcing its way and flowing out at the anus. The diameter of the intestine is very small; but when we take into consideration the extreme slowness with which the digestive powers operate, we shall find it sufficiently large to answer all the purposes for

which it is intended. In the *H. sanguisuga*, whose digestive powers are very active, the intestine is more than double the width of that of the *H. medicinalis*; and the *anus*, or that foramen in which it terminates, bears also a proportionate enlargement.

SECTION THE FOURTH.

The Diseases, Preservation, and Management of the Leech.

As an auxiliary remedy in removing many distressing symptoms attendant upon disease, the Leech stands very conspicuous, and we have to regard it as rather a fortunate occurrence, that it comes in so opportunely to our aid in all those cases where we run some hazard in having recourse to the Lancet. Its employment has been at no time so extensive as at the present. To its beneficial influence alone, notwithstanding its occasional high price, is it now indebted for having a place among the common

routine of remedies administered in Hospital practice. At the Hospitals in Birmingham, from the demand being considerable, an individual has been for some years enabled to provide for himself and his family, by furnishing and applying Leeches throughout the whole year at a stated price.

Indeed if this plan were more generally adopted, it would save the lives of an immense number of Leeches that now fall a sacrifice to mismanagement, and have the effect of securing to us at a moderate sum, unless in very severe seasons, an abundant supply.

My friend, Mr. Estlin, surgeon of this city, conceiving that a similar practice would be here attended with advantage, gave a few directions to a poor woman how to apply and afterwards treat them; thus laudably putting her in the way of obtaining a decent livelihood. In private families where Leeches are recommended, they are frequently, after being applied, thrown aside and regarded as

of no further use. By employing a person to apply them, the advantage to be gained from their use is obtained at an equally reasonable rate, and the Leeches are reserved for some future occasion. Besides, great deception may be practised in families, in regard to the Leeches they buy. This will not, I allow, happen, if the purchase be made in regular shops, where the credit of the dealer is at stake, but may be occasioned by some designing person selling Leeches totally unfit for medical use. I shall give an instance in point. A friend of mine, who was in the almost constant habit of using Leeches in his family, accidentally met a man in the street, offering Leeches for sale; who assured him that they were of the proper kind, and such as he served the doctors with. The price asked being much below the shop-price, my friend was induced to purchase nearly a hundred; but upon his return home, on shewing them to a medical

gentleman, he was informed they were of no value.

To prevent any imposition of this kind, I shall state, for the benefit of my readers, that unless a Leech is marked with yellow rings or spots, or with variegated lines running the whole length of the back, it will in general be found useless.

Leeches are subject to great mortality, arising chiefly from three particular diseases to which they are liable, and which I shall now proceed to notice.

1. An ulcer seated on various parts of the body, but more generally affecting the side. The part on which it is situated is usually contracted.

When this disease first manifests itself, it presents only a small ulcerous speck, which in the course of a few days spreads with such rapidity and malignity as to destroy life.

This ulcer is frequently tinged with blood, and occasionally works a passage internally. Sometimes it is of little or no depth, and of no extent, appearing to be a simple abrasion of the skin. Trifling, however, as this may seem, it proves, as many must have witnessed, abundantly destructive.

2. Another disease, of equal malignity, is, when one portion of the body is narrowed in its diameter, and rigid, whilst another portion is studded with tumours, which, on incision, present nothing except black, putrid, coagulated blood.

3. A disease that occasionally falls under our notice, and in its pernicious tendency equals those already described, is, when the whole body puts on a flaccid appearance, with the exception of the lips, which are hard, swollen, of a purple cast, and frequently bloody.

All these affections I at one time attributed to our present mode of keeping Leeches, that is, in small vessels, and greatly crowded. Mr. Baker, however, acquaints me, that he has frequently seen Leeches taken from their native abode, labouring under these several states of disease. But when thus found, their liberty is again restored to them, in order to prevent the contagion spreading among those already caught and in good health.

These diseases (more particularly the ulcer, which I have found an almost constant attendant upon the *H. vulgaris*) are particularly prevalent during the summer months. And as they invariably proceed to a fatal termination, we should, when we find a Leech in the least degree indisposed, immediately remove it from the rest, to prevent the usual ill consequences.

Although we are not in the possession of

any effectual remedy to check the progress of these destructive diseases, we are still fortunate in being enabled to guard against their so frequent occurrence. This is to be done by keeping them in capacious stone jars or other large vessels, in the manner I shall presently notice.

The water in which Leeches are kept sometimes assumes a bloody tinge, when the Leeches are to all appearance, in good health. Should this still take place after its frequent renewal, we may expect a great mortality; to obviate which, or at least to lessen its effects, it would be prudent to separate them, keeping only a few together. The temperature of the water should be, as much as possible, preserved uniform: all extremes of heat and cold should be avoided; and a situation should be chosen free from any unpleasant smell.

Although it be adviseable, every seven or

eight days, to change the water, yet the following instances will shew that it is not absolutely necessary.

Dr. Ferguson kept Leeches more than a twelvemonth, and only renewed the water two or three times; which, he observes, continued pure, sparkling, and free from smell. The only change noticed was, that a small quantity of greenish matter had gathered around the sides of the vessel.*

I learn from a medical practitioner in this city, that he once kept a Leech in water unchanged nearly two years. When the Leech died, it was reduced to about one third of its original size. The water, during the whole of this time, as in the case just noticed, had no unpleasant smell.

The author once kept a single Leech in water unchanged during the summer-months, and he found it equally active with others,

* Medical and Physical Journal, vol xiii. p. 302.

where the water was renewed every second day.

When Leeches are kept in any considerable quantity, I would recommend them to be placed in a large vessel, provided with a false bottom so perforated as to allow them a ready passage. This false bottom should be raised from three to six inches above the real bottom, or to such an extent as will admit of a turf,* of nearly equal dimensions, being placed between them. It should fit closely to the sides, that the earth may not be

* The turf, from its fibrous and matted structure, affords to the Leech a ready means of disencumbering itself of the epidermis; which, if suffered to remain, would not only prove troublesome, but occasionally give rise to disease. The Leech-dealers frequently bring with them the Marsh Horse-Tail *(Equisetum Palustre)*, which answers the same intention. Of this plant, in its dried state, in the early part of spring and before the aquatic plants have acquired any growth, they avail themselves, to lure the Leeches to the surface, in order to their being more expeditiously caught. It is usually thrown in an evening into ponds, &c. on the surface of which it remains, and in the morning the Leeches are found enveloped in its folds.

disturbed by the frequent introduction of fresh water. It is necessary that the vessel be also furnished with a stop-cock, that the water may be drawn off as often as it may be considered expedient.

But previously to our placing the Leeches in this vessel, they should be singly examined. If, on being handled, they contract, and feel hard and firm, it affords the best indication of their being healthy; but should they feel flabby, or exhibit protuberances or white ulcerous specks on the surface, they should be kept in jars by themselves, the water and the turf of which should be frequently renewed.

We now pass from the Preservation of the Leech, to its Mode of Application and Treatment.

When the application of Leeches is judged expedient, the part on which it is intended they shall fix, should be as clean as

possible: it should therefore be first washed with soap and water, and afterwards with water alone; which will be the more necessary, should any liniment or embrocation have been used.

The Ancients recommend us to remove Leeches from the water, an hour at least previous to their application, on the ground that they are thus rendered more voracious, and affix to the skin with the greater readiness. Such is the practice even in the present day; and we find it frequently attended with success.

Leeches are commonly affixed by inverting a wine-glass containing as many as may be required, upon the part affected. The great disadvantage of this practice is, that some of them frequently retire to the upper part of the glass and remain at rest, defying all attempts to dislodge them, without incurring the risk of removing those that may have already fastened.

To remedy this inconvenience, I would recommend the employment of glass-vessels of various sizes, but none of them more than an inch in depth. They should be made to assume various figures; such as that of a diamond, half-moon, &c. In Opthalmia or Inflammation of the Eye, a glass of the half-moon shape might be used with advantage. But, for my own part, I always trust to their application by the hand. Bring a Leech toward the part whereon you intend to fix it, and as soon as it begins to extend the head, to seek an attachment, endeavour that it may affix itself to the place required. Some little dexterity is requisite to make the Leech attach itself at the first point of contact, or it often happens that it will pass over a great extent of surface, without evincing the least disposition to bite. In this case, puncturing the part with a lancet offers the only chance of success. When the patient is fearful of the lancet, and one Leech only

shall have bitten, where several are required, it may be of use to remove it, which is readily done, by inserting the nail of the finger between its mouth and the skin. The blood then flowing from the orifice, will induce the remainder to bite with the greatest avidity. As soon as the Leeches are gorged, they drop off; this usually happens within ten or fifteen minutes. Sometimes they remain affixed a considerable time, and become indolent; but they are quickly roused from this state by sprinkling them with a few drops of cold water.

The Leech, when filled, contains from half an ounce to an ounce of blood; and what is worthy of notice, this fluid is preserved in its stomach, in an uncoagulated state, for two or three months, and without producing any offensive smell. The only change it suffers, is that of becoming deeper in colour, and a little thicker in consistency.

Under some peculiar circumstances the blood, however, will coagulate, and it is then productive of disease. What peculiar action takes place in the stomach of the Leech, to preserve for so long a time the blood in a state of fluidity, we cannot well determine. It may, however, be urged as probable, that a fluid is secreted, capable of resisting the developement or play of those affinities which are essential to the putrefactive process.

When a Leech quits the part to which it was affixed, and the blood continues to flow longer than is required, the application of a slight compress will usually restrain it; but should this at any time prove ineffectual, we must have recourse to a compress steeped in some styptic, as brandy or spirits of wine.

When from their scarcity but few Leeches can be procured, advantage may be taken,

according to an ancient custom, of snipping off their tail; the blood will then flow, drop by drop, from the artificial opening, as fast as the Leech sucks it. But it is of no use to resort to this operation unless the Leech is in the act of suction; for should the pressure from the column of descending blood be removed, this artificial opening would be immediately closed by the strong action of the circular muscles. With the same view an incision may be made close to the tail of the Leech, with a lancet.

I have frequently performed this experiment, and what is remarkable, have found them to suffer, apparently, so little from the operation, that they still drew the blood with as much freedom as before. In one instance, in a Leech just fallen off and fully gorged, I employed this method of ridding it of its contents; and, severe as many might deem this treatment, the Leech was no sooner returned to its former situation, than it began

sucking with the same avidity as when first applied. Although the Leech appears at the moment to suffer from this practice but trifling inconvenience, yet it afterwards becomes very languid: I would therefore only propose its adoption, at a time when, as before noticed, their scarcity might render such a measure expedient.

To make a Leech disgorge, the most common practice is, that of strewing the muriate of soda, or common salt, over its body. In a few seconds the blood is rejected, the Leech assumes a coiled form, and loses its activity and vigour; and we seldom find it again fit for use, until the expiration of four or five days.* As the salt frequently blisters

* Upon this subject, Horn says, rather quaintly, "Those persons do not consider that blood is the most favourite and salutary nourishment of this extraordinary creature [the Leech]; and I would ask such inconsiderate persons, how they would feel themselves if, immediately after eating a hearty dinner, any person was to give them a violent emetic?"

the body, we are advised to apply it only to the mouth; but I must remark that if the lips are blistered, the same obstacle is presented against its re-application.

To remedy this inconvenience, we are recommended to draw the Leech between the thumb and finger of the left hand, keeping up a regular and uniform pressure, until the whole of the blood is removed. This practice is certainly preferable to the former; for the Leech continues active, and will again immediately affix itself. But the great disadvantage is, our being scarcely able to carry it into effect without injury to the internal structure.

In preference to any of these methods, and one from which the Leech appears to suffer the least inconvenience is, that of pouring a small quantity of vinegar upon the head. Following this mode of treatment, I have succeeded in making a Leech bite four times successively, coming off each time completely gorged with blood.

It will be scarcely necessary to observe, that Leeches recently applied should be kept by themselves, and should be allowed to retain for their nourishment and support, about one third the quantity of the blood they extract.

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J.R. Johnson
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